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CONTENTS

What Next in Progressive Education?, *by George B. Cox* 207
Documentary Methods and Techniques for Data Gathering — II, *by L. F. Ashley* 209
Offset Lithography, *by R. Randolph Karch* 211
Intelligence and Employability, *by W. F. Oppermann* 213
Auto Economics, *by Carlton E. Dwight* 214
Controlling Production Work, *by Harry P. Bubolz* 216
A Dictionary Test, *by Richard M. Bell* 217
Survey of the Neon-Sign Industry, *by Abraham Diamond* 218
Editorial 219

Problems and Projects

Book Ends, *by V. L. Pickens and L. L. Bowen* 223
Potato Masher, *by Laurence Pitcher* 223
House Wiring, *by Charles A. Bacheller* 223
A Hunting Knife, *by Gerald A. Boate* 224
Bracelet with Chased Design, *by William J. Becker* 225
Book Ends of Copper or Pewter, *by E. W. Manzer* 226
Making Edge Bends in Band Iron, *by Joseph J. Lukowitz* 226
Candelabra, *by Colin D. Robertson* 227
Legend of the Clock Dial, *by Melvin F. Hall* 227
Nail and Screw Box, *by George W. Bowen* 228
Observatory for School or Home, *by John N. Willmott* 228
Simple Foundry Work, *by Gerald A. Boate* 230
Sandals, *by W. Ben. Hunt* 233

Supplement

Architectural Drawing Test, *by Will G. Rodeman* ..... No. 342

Personal News 232
Association News 232
School-Shop Equipment News 9A

IN THIS ISSUE

This number of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION has been prepared especially for the shop teacher who is anxious to improve himself professionally.

He will find Dr. Ashley's "Documentary Methods and Techniques for Data Gathering" and Professor Cox's "What Next in Progressive Education" particularly thought provoking.

W. F. Opperman's "Intelligence and Employability" will appeal to many who have to deal with low I.Q. students.

Abraham Diamond's "Survey of the Neon-Sign Industry" will not only interest the teacher of electricity, but it shows a method that may be applied to other industries and occupations as well.

The problems-and-projects section contains a number of articles that can be put to immediate use in boys' camps. Chief among these are "Sandals" by W. Ben. Hunt; "Bracelet with Chased Design" by William J. Becker, "A Hunting Knife" by Gerald A. Boate, and the "Book Ends of Copper or Pewter" by E. W. Manzer.

VACATION TIME

Good weather, good roads, good swimming, good fishing, good clean enjoyment, good times galore, is what INDUSTRIAL ARTS AND VOCATIONAL EDUCATION wishes all shop teachers for the 1937 vacation months.

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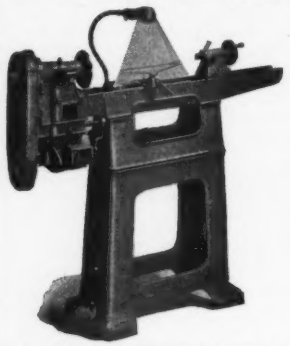

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INDUSTRIAL ARTS and VOCATIONAL EDUCATION

July, 1937
Vol. 26, No.7

What Next in Progressive Education?

George B. Cox

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From an address delivered by the author before the Industrial-Arts Section of the Inland Empire Education Association, Spokane, Washington, April 7, 1937.

During the past several years there have come to the field of education a number of new terms, movements, and fads. Fads are like street cars; don't run after one for there will be another along soon! But *some* of the new ideas in education are likely to be more lasting — more fundamental than "fads." Because "education" is still an inexact science — one for which exact measurements have not been devised — it is natural that many theories will arise to be tested by trial. This has been true in all fields — even in those we now call the "exact" sciences — until theories were proposed that led to the invention of methods and instruments of exact measurement.

In recent educational literature, there has been much discussion of capital P *Progressive Education,* of the activity program, the integrative curriculum, and the child-centered school. It has been implied that not all education is progressive, and that much of the present-day methods, techniques, and subject-matter programs are hopelessly outmoded.

What is Progressive Education? Modern Education?

What is "Progressive Education"? Does it differ from "Modern Education"? Let us begin with the "modern" and see if we can discover what is necessary to make it "Progressive." Is the term "modern" applied only to that which is *current?* Is a Model T Ford modern? There are still a number of them in current use. Or is the "Scarab" car — that marvel of stream-lined extremes designed by William Stout and shown about the country two years ago — a "modern" automobile? Upon what does the term "modern" depend? When applied to the automotive field, I believe it is safe to say that neither of these extremes — Model T Ford, nor the "Scarab" beetle car — represents a *modern* unit. Automotive engineers say that no stock model built today is truly modern — that only the designers and engineers are fully aware of the revolutionary advances we might already have realized. But the industry must content itself to build something less perfect than the engineers and designers are anxious to give us. Why? Because the buying public must be educated to the change! The public "taste" — acceptance of aesthetic values, traditions, customs, habits of thought and action — changes slowly, even in this day of speed.

The "public" is slower in the acceptance of changes in an educational system than in automotive design — slower in sanctioning educational change than in changing the customs of government. Witness the "isms," panaceas, administrations, authorities, and financial aid in the billions — to everything under the sun except education — that have come from the state and federal governments of recent years.

Modern Education Defined

But, again, what is "Modern Education"? If, like the automobile, it is neither extreme of current practice, perhaps "modern educational practice" might be defined as *that which, in the opinion of the great mass of informed educators and enlightened patrons, represents the most advanced practice the public will support, defend, and patronize; that from which the public receives the greatest return in citizenship, in character, in vocational and professional training, in* all *the objectives which have a place in a system of public education in a democracy.* If that constitutes "modern education," then the *extremes* are out. Some schools, according to that definition, are less than modern and others are ahead of their times — even as the Model T and the "Scarab" automobiles.

Progressive Education Defined

If modern education represents the best of current practice, in terms of that which is "proven up," then what of progressive education? To return to our similitude — the 1937 models of automobiles are "modern," the Model T is outmoded, and the "Scarab" car is "progressive." In fact, it is so much in the vanguard of progress that it cannot yet be manufactured and sold in paying quantities. It is futuristic. Really, progressive education is just a step in advance of modern educational practice, but the capital P "Progressive" educators will have us believe their "brand" of "Progressive Education" is so far in advance of *the best current practices* as to be "futuristic" or idealistic. The "progressive educationalists" — largely psychologists and professors of educational theory — like the automotive engineers and designers, can admittedly see possible advances far out in front of that which is "modern" in the sense of the best current practice. But again, like the new designs in the automotive field, the "advance models" of educational practice should be experimented with in private, tried out on the proving grounds and found to be successful *before* they are put into general use.

Progressive Education and the Teacher

What of progressive education? What should *or can* the average teacher do to be "progressive," or to be ready for the use of these "new models in education" when they have been proved worthy and "put on the market"? Perhaps the best preparation is to keep the present models, the modern school system, functioning well! To be informed on the best current practice, objectives, methods, and techniques is the obligation of every teacher in every age. More than that, one should take a look at the "new models" occasionally, just to see what real improvements have been made — to see if the old model is really out of date. But don't be fooled by a lot of new gadgets placed there for sales appeal only! Just a change of line here, a tilt of the windshield there, and a new color scheme may have made

the new model *look* more attractive *without increasing its efficiency or real value!* Don't neglect the present model while the new model is under trial!

Present Trends

In education, as in automotive design, it is possible to look ahead — to predict the trend at least in part. As in automotive design, so in education, *improved efficiency* should be the controlling factor in the adoption of any new model of educational practice — improved efficiency in terms of reduced costs of public education or increased quality of output.

In educational practice, the trend is toward a *more functional subject matter* and toward improvement in methods of instruction. In the new curriculum, the objectives all begin in the participial form, indicating a positive participation — a "doing" by the pupil of something desirable. No longer is passive information in itself considered functional. Many of us can remember when the schoolroom was filled with mottoes. Trite sayings, proverbs — "Virtue is its own reward," "Happy is he who contributes to the welfare of mankind," "Knowledge is Power," and the like — must nowadays be transformed into *action* if they are to interest and advance the pupils by means of positive participation.

How new, how modern, how progressive is "Progressive Education"? Rousseau, the French writer of the sixteenth century, advanced the philosophy that children learn better if taught by natural methods. He would have children learn from "circumstances," spending a large amount of time on nature study and the "manual" arts. Rousseau's philosophy is indicated by the following quotation:

"Direct the attention of your pupil to the phenomena of nature, and you will soon awaken his curiosity; but to keep that curiosity alive, you must be in no haste to satisfy it. Put questions to him adapted to his capacity, and leave him to resolve them. Let him take nothing on trust from his preceptor, but on his own comprehension and conviction; he should not learn, but invent, the sciences. If ever you substitute authority in the place of argument, he will reason no longer; he will be ever afterwards bandied like a shuttlecock between the opinions of others."[1]

"If instead of making a child stick to his books, I employ him in a workshop, his hands labor to the profit of his mind, he becomes a philosopher, but fancies he is only a workman.

"It is necessary that he work like a peasant and think like a philosopher, lest he become as idle as a savage. The great secret of education is, to make the exercises of the body and the mind serve as a relaxation to each other."[2]

Pestalozzi, the Swiss educator of the sixteenth century, and an admirer of Rousseau, was able to put many of the latter's ideas into execution in a private school at Berne, Switzerland. Then, in succession, came Fellenberg (1771–1884), Herbart (1776–1841), and Froebel (1783–1852), all contributing to the philosophy and methods of early education. It is significant to note that these same philosophies are the very foundations of what is now called *progressive education.*

In more recent times, Herbert Spencer has said, "The great aim of education is not knowledge, but action," and Dr. John G. Hibben, late president of Princeton University, said, "Education is that which gives one the ability to meet life's situations."

So long as children are "in school," schooling to them *is life.* It is not considered by them as preparation *for* life. It is to them a definite part of *life itself.* A progressive system of education will recognize that fact, and if the full capacity of the child is to be utilized, the curriculum must include those subjects, activities, and methods of instruction which appeal to the business of childhood, and which stimulate the active participation of children because of the realization that *school is life.*

The old method was to isolate the *facts* as *adults* saw them, to *present information* of the nature that *adults* believed valuable, and to supervise the *thinking processes,* even to the extent of *dictating what to think* about the facts presented. My parents taught me to believe that liquor, tobacco, and religious beliefs differing from their own, were *wrong.* Teachers often have much the same set notions. While religion is taboo as a schoolroom subject, on other matters many teachers dictate both the *facts* and the interpretation of those facts.

Progressive education, *old and new,* places activities and pupil-participation above the passive reception of facts. It is more important, according to progressive educators, that children be taught *"how to think, to reason,* than *what* to think." Fundamental information and facts are still to be presented, but as realistically and as naturally as possible. It is the concern of the progressive school that each student, in proportion to his maturity, should be:[3]

1. Acquiring the skills basic to learning so as to use them effectively in further learning and thinking.

2. Understanding, appreciating, utilizing, and extending the intellectual and the aesthetic resources of the cultural heritage.

3. Learning to appreciate and to help develop ethical, aesthetic, and spiritual values as a basis for right conduct.

4. Preparing for more effective participation in suitable occupational activities.

5. Functioning intelligently and cooperatively as a member of a family.

6. Discharging intelligently and freely civic and governmental responsibilities.

7. Discharging intelligently and freely *other* group and individual responsibilities.

8. Establishing, maintaining, and improving physical, and mental health.

9. Participating in more constructive recreational activities.

If we read these objectives correctly, it is evident that there is implied a marked "doing" of certain things by the pupils. All of them denote *action;* each statement begins with a participle. Several of the objectives involve practical life situations that come through living the experiences in as nearly a realistic manner as possible. It is significant that *these* are the objectives sponsored by the Progressive Education Association.

Prophesied Developments

It seems logical to predict that education at the secondary level, *if not at all levels,* will become more indicative of real life situations, more practical in outcome. To the children of whatever age, *school will be life itself,* just as the vocation of an adult.

At present, one of the "fads" of educators is the so-called "integrative curriculum." While it is true that some parts of our system have become over-departmentalized — set off into almost air-tight compartments — it is also true that there is danger that the pendulum may swing as much too far in the other direction. The education of the "whole" child is a good phrase but the sponsors of the integrative curriculum should remember that a brick wall is built a brick at a time — not all at once. Differentiation precedes integration. Children learn most readily from specific cases, and then pass on to generalizations or to a treatment of "the whole."

One serious mistake, it seems to me, is that the experimenters have insisted upon the English social studies as the "core subject" around which all other activities of the integrative curriculum will be grouped. Imagine an active child believing a real society built about such an academic setting! Would it not be better to center the education of the whole child about the real problems growing out of the practical studies of food, shelter, and clothing? Practically all of the instru-

[1] Rousseau, J. J., *Emilius and Sophia,* or *New System of Education.* Translated from the French "by the translator of Eloisa," 1763, p. 111. Quoted from Bennett, C. A., *History of Manual and Industrial Education Up to 1870,* Manual Arts Press, Peoria, Ill., 1926, p. 79.

[2] *Ibid.,* p. 115. Quoted from Bennett, *History of Manual and Industrial Education Up to 1870,* p. 80.

[3] The order is on a basis of logical sequence rather than on a basis of relative importance.

ments of society, even language itself, have developed as an outgrowth of the desire for food, shelter, and clothing in abundance, and with a degree of security possible only in an organized society. The practical arts — homemaking, argiculture, commercial pursuits, and the industrial arts — would seemingly constitute a "core-subject" group that will provide the maximum opportunity to integrate the whole curricular program in an active and realistic manner not possible with an artificial, passive "core subject" that has come into being as a mere instrument or tool of social development.

It is the belief of the writer that the next really progressive development in education will include the following:

1. *In the elementary schools*

A *directed* activity program centered about the *practical arts*, with science, the social studies, and the "three R's" closely correlated thereto. The practical-arts activities of these early years should be realistic. They should be treated as media of visualization and expression rather than as technical ends in themselves. To the children they should be *experiences in real life.*

The teachers should be trained very briefly in the *general subject-matter fields* of the practical arts as well as in general science, social studies, and the three R's; but especially these teachers should be *masters* of child psychology and of the methods and techniques of instruction suited to respective age groups of the elementary grades.

2. *In the junior high schools*

In the beginning of semi-technical education, continuing the realistic practical-arts core of the grades but substituting more direction, more departmentalization, than in the earlier program. Integration should not be lost, but the groundwork should be laid for the development of special interests and aptitudes. The activities should be of an exploratory-technical nature.

The teachers should receive a more highly specialized training, each within his or her *special* field or fields. In addition to the specialized training each teacher in the junior-high-school program should know the objectives of both the elementary school and the senior high school, should be informed on and sympathetic with the principles, objectives, and techniques of guidance, and should be able to render some degree of effective social orientation.

3. *In the senior high schools*

The *beginning* of specialization. The aim will be differentiation in the special fields and *integration* in the social subjects. Here, the social-economic group should become the integrative core, but ample provision should be made for the continuance of the practical-arts subjects and for the beginnings of vocational preparation.

Further specialization should be provided in the sciences, the arts and crafts, homemaking, agriculture, commercial subjects, and in the significant industrial occupations. *For those not contemplating college, vocational preparation should be intentional and intensive, at least in the last years.*

In the senior high school and above, the training of teachers should be still more highly specialized, than in the junior high school. But the highly departmentalized organization of both the high school and the teacher-training center should not overlook an even greater necessity at the high-school level for an effective program of social orientation and social control. To that end, every teacher, however highly specialized in his own subject-matter field, should be trained for functional service as an adviser and leader. Student self-government will furnish a laboratory for active participation, but "every teacher a leader" will give the "integration" necessary to success in the social program.

4. *In the junior-college years*

A fully differentiated specialization for those in the vocational group, and general college preparation for those contemplating further study in higher education.

Documentary Methods and Techniques for Data Gathering — II

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This is the second of a series of four articles on industrial-arts research.

Attention has been directed to the divisions of historical materials, "The Scientific Method and Historical Research."[1] Brief statements showing distinctions and comparative importance were made. However, certain applications and explanations will make these materials accessible and more usable.

Suppose, for example, that one is interested in the origin and development of apprenticeship. What are the likely sources? One's probable first thought would be texts on history. Along with texts other printed and written materials may be found to contain information. Biographies and autobiographies, like that of Benjamin Franklin, for example, will contain some facts pertinent to the subject.

Laws, old and new, have often been concerned with apprenticeships. *The Code of Hammurabi* contains statements regarding the duties of the master in teaching handicrafts, and makes clear that apprenticeships existed 2,250 years before Christ. Excavations in Chaldea have brought forth numerous stone tablets on which are written indentures of apprenticeships in tile and brickmaking industries. This is further evidence of the great age of the apprenticeship institution. Search for evidence would certainly take one to museums where can be found pertinent material in old newspapers and books on this matter along with other material evidence. Craftsmanship of different periods might be expected to yield some information. This would include materials found in the ancient tombs of Egypt which indicate the presence of various crafts centuries before Christ. The quest for information leads one through the three major divisions of historical materials, written, oral, and artistic productions which Vincent[2] classes as consciously transmitted information. Such material has been left for a purpose, and therefore may be expected to have a certain bias. This will need to be determined by the research worker and proper allowance made for it. In this class belong chronicles, annals, biographies, memoirs,

[1] See page 173, June, 1937, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION.

[2] Vincent, John Martin, *Historical Research* (New York: Peter Smith), 1929, 350 pp. See p. 18.

diaries, genealogies, and certain classes of inscriptions.

The class of material known as *oral tradition*, including ballads, anecdotes, tales, and sagas, as well as the material known as *artistic productions*, belongs to what has been designated "consciously transmitted information." Oral tradition can yield little of value in industrial-arts research other than to give an idea of the customs and beliefs of the times. Artistic productions, however, may yield a great deal of value. They include historical paintings, portraits, scenic sculpture, and coin types. The portrayals, the processes, and techniques tell much about different periods in which the producers lived.

Much of the museum material comes under the class known as relics, and includes human remains. Information from this class is known as *unconscious testimony*. It has not been left for a purpose and is accessible only by accident. It includes languages and institutions; products of the hand, implements, fine arts; products of the mind, business records, literature.

Vincent (*Ibid.*, 236) says with regard to human remains:

> It seems a gruesome task to pry open the tombs of the ancient Pharaohs and to rummage in the sacred relics of the royal dead, although many thousand years have passed since some of them were laid to rest. The results, however, are of the greatest scientific interest. Not only the method of burial, the utensils and ornaments deposited in the tomb, but even the human relics have thrown light upon the history of Egypt. The racial characteristics of the dominant class, already indicated by the pictures, are confirmed in many cases by desiccated fragments of the men themselves.

The tombs of the Pharaohs, recently opened have disclosed much of interest to the industrial-arts student and teacher relative to handwork produced during the period of their reign. Interesting pottery, textiles, and furniture, such as was used in a distant day, throw light upon the customs and home life of the people, as well as upon processes of manufacture.

It is hard to draw a line between some of the consciously transmitted information and unconscious testimony. For example, the stone tablets which have been brought to light in Chaldea may be either conscious or unconscious testimony. However, it is likely that they belong with relics. The same may be said of the decorations in textiles and pottery found in ancient tombs. They belong with the class of artistic productions, but they can scarcely be said to have been produced for transmitting consciously. The purpose here has been to enhance the appearance of the product. One has the same question in viewing many other products of the hand, such as the armor of the twelfth-century knights. No more exquisite workmanship in metal has been produced by hand than some of the examples of armor which have been preserved until this day. Yet we call these relics because they were not produced for posterity, but for the time in which they were used. From the standpoint of historical research in industrial-arts education, these products of the hand furnish a major portion of the evidence of development through the ages.

Regarding products of the mind, such as business records and literature, the contribution to the industrial-arts field lies in such literature as unconsciously portrayed defects in educational theory and led to conscious writings for the same purpose. An example is the *Code of Hammurabi*.[3] This is a set of laws to govern a nation. One reads the following among them:

> If an artisan take a son for adoption and teach him his handicraft, one may not bring claim against him. If he do not teach him his handicraft, that adopted son may return to his father's house.

These laws are obviously consciously transmitted information, but for the student of historical research in industrial-arts education the code may be considered a relic producing unconscious testimony of the fact that handicrafts were highly developed twenty centuries before Christ.

The last major division of historical materials as given by Vincent[4] consists of inscriptions, monuments, and public documents of certain classes. Any of these may have qualities belonging to the other two major divisions already described. The remains of the Parthenon, the Acropolis, and other architectural ruins furnish the basis for the studies of architecture and construction leading to modern civil engineering. The same may be said of certain monuments, such as the pyramids of Egypt and the recently discovered Aztec monuments in Central and South America. *Public documents* have already been referred to.[5]

Constitutions, laws, and charters may hold ideas concerning education which have either directly or indirectly influenced the installation of activities as school subjects. An example is the Morill Act of 1862 in the United States, making possible grants of money for agriculture and mechanic arts and establishing colleges and universities. Court decisions, such as those applying to child labor, have a bearing on school-leaving and types of schoolwork. The long series of legislative acts in England in this direction during the nineteenth century will be of interest. The records of executives and other government officials, together with proclamations, are valuable sources and may easily be classed as consciously transmitted information or unconscious testimony, depending upon the purpose served. Vincent[6] speaks of the *Doomsday Book* which was a statistical survey of England and from which one can infer the extent of cultivation of the land and form an estimate of the population. One notes the primitive condition of some of the municipalities. The names of the people give an idea as to the distribution of races and the extent to which the Norman invaders had taken possession of the soil.

Students of research in architecture will find considerable information in parish records where the extent of church building before and after the reformation may be ascertained.

War dispatches tell something of the movement of armies, equipment, and materials used. From these can be inferred the advances made in metallurgy and military engineering.

Private documents, such as laws, deeds, medieval land records, rent rolls, private account books as described by Vincent, furnish information regarding property, methods and terms of measuring, methods of marking property, approximate values of property, process of keeping records, and innumerable other historical items valuable to a variety of studies. The method of making account books is in itself a process dating back to the beginning of history. Evidence of this is bountiful in the numerous Assyrian tablets and the medieval parchments. From these ancient personal belongings to those of modern times, including the wealth of printed material now available, is a long step, and a volume would be needed to describe all that these materials hold for the research worker.

Newspapers are valuable from many standpoints and for a host of different types of study. One may find in the museum filed quantities of papers of various ages and giving information on every type of human interest from the situation of the Negro slave to the latest invention. The student of educational research should not forget this source of information.

An attempt has been made to show the extent of historical materials which one may class as documents. These have been shown to be of three large classes, which may be designated as general, public, and private. They consist of consciously trans-

[3] Bennett, Charles A., *History of Manual and Industrial Education up to 1870* (The Manual Arts Press), 1926, 461 pp. See p. 13.

[4] 2, N. 1.

[5] See page 174, "The Scientific Method and Historical Research" in the June, 1937, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION.

[6] *Op. cit.*

mitted information, relics, inscriptions, and monuments. This large field for the research worker contains all kinds of fascinating materials, such as have been brought to light through excavations and discoveries, together with the consciously preserved materials which one finds in large libraries and museums. It is the task of the research worker to locate these materials and to analyze them for such pertinent information as will apply to his study. If the materials happen to be consciously transmitted information, he needs to know how to arrive at truth through an analysis of the writer's bias in the given situation. If the materials require translation, he must be capable or must be able to employ someone who is capable of translating accurately in order to arrive at the meanings portrayed. Having acquired and tabulated the materials available for a given study, it then becomes the duty of the writer to arrange these materials in such order as to best develop the problem which he has undertaken according to the methods of scientific research. The same rules with regard to internal and external criticism must be followed, and the conclusions must be so set down as to show that the writer has undertaken and developed a problem in such a manner as to make it a worthwhile research.

Offset Lithography

R. Randolph Karch

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A related-subjects lesson for the school printshop.

Those who peruse the printing-trade journals and current advertisements, and listen to the speakers at printing educational meetings, get conflicting stories of the probable future of offset lithography. Many writers and speakers believe that soon the printing establishments of the nation will be "sans type, imposing stones, and lead and rule cases," and instead be equipped with cameras, photocomposing machines, printing frames, and offset presses. Others believe that offset will make inroads on letterpress printing in certain classes of work, and stop there.

The writer does not know how much letterpress printing business will "go offset" in the future. This depends largely upon improvements to come in each industry. It is well to remember, however, that the letterpress has not changed materially since 1450. In the march of progress, changes in the graphic arts are sure to come. On the other hand, fifty years ago some predicted that the slug-casting machine would throw thousands of hand compositors out of work for all time, when as a matter of history, more men have been put to work in the printing industry since the invention of the slug-casting machine than were employed before. The cheapened production methods made possible larger newspapers and magazines and the great increase of general advertising matter.

The phenomenal growth of offset is not to be ignored by the far-seeing printing instructor and administrative officers of the schools. In the space of a few years, offset has risen to be one of the three great divisions of printing.

There is some confusion of terms in offset lithography. It is known also as "photo-offset," "planography," the "planographic process," and a host of local trade names, just as the collotype process is suffering under such names as "photogelatin," "Heliotype," and "Albertype." For the sake of clarity in this article, the process will be called simply *offset*.

The Origin

Lithography was originated by Senefelder some years ago. At that time and until recently *calcareous* stones were used. A greasy medium was used for drawing designs and lettering upon the face of these stones. The affinity for grease on the other parts of the stone was destroyed by applying a gum solution. The stone was dampened with a felt roller, and following that, inked by rollers. The moisture from the dampening rollers was absorbed by the blank parts of the stone, and repelled by the inked parts. Conversely, the greasy ink used was repelled by the dampened parts of the stone, and clung to the greasy portions. Then the impression was made from the stone on the paper. Often the sheets were run fifteen times through the press to get the desired color results. Now this is done by offset in five or six impressions. (See Fig. 1 for graphic explanation of lithography.)

The Process Today

At present the old lithographic stone has been replaced by the aluminum or zinc plate, with a grained surface. These plates, which can be stretched around a cylinder, made possible the rotary-press principle, with its great speeds.

Recently the offset method came into being, in which the plate is mounted on a cylinder, dampened and inked, and the designs and lettering are *transferred to a second rubber-blanketed cylinder, from which the ink is transferred, or "offset," to the paper.* (See Fig. 2 for graphic explanation of the offset principle.)

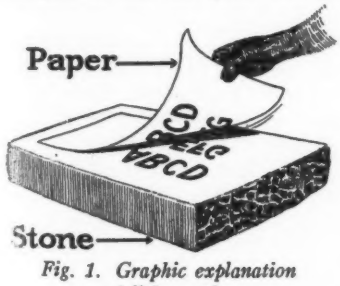


Fig. 1. Graphic explanation of lithography

Offset-Plate Making

Offset plates can be prepared by three methods:

1. By drawing directly on the prepared metal plate, using a lithographic ink or greasy crayon.
2. By transferring the design or lettering to the plate by making an impression from the original plate with a specially prepared transfer paper using transfer inks.
3. By applying the printed image on the offset plate by photographic methods, which is by far the most popular method used today.

The offset printer usually has the plate-making equipment and, of course, the presses, in his own establishment. Camera work (furnishing the negatives) and artwork are usually done butside of his plant by the photoengraver and commercial artist.

The zinc plates are *grained* in a trough with marbles, special graining material, and water. After rotating for about an hour, the plate is sufficiently grained and ready for further preparation.

The grained plates are then prepared

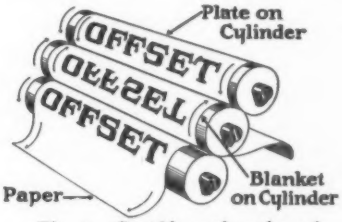
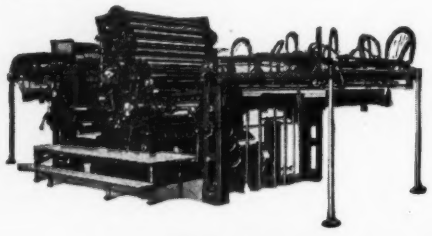


Fig. 2. Graphic explanation of offset principle

with a coating of albumen or fish glue in a *whirling machine*, and treated with *ammonium bichromate*, which hardens when exposed to light. The parts of the plate that are unexposed to light remain soluble in water.

The negative is put in contact with the plate in a *vacuum printing frame*, and arc lights make the exposure. The coating under the clear lines of the negative hardens, and is coated with a thin film of ink. A soaking in water removes the albumen from the unexposed parts of the plate.

Halftone screens, usually from sixty to one hundred fifty line, can be placed in front of the negative in the camera to produce *tones*, and colors can be separated with *filters* used with *panchromatic plates*. Science enters here in measuring the exposure by means of the photo-electric cell.



One- and two-color offset presses

After *retouching*, the plate is ready for the press. The zinc plate may be *regrained*, usually in the offset plant, and used again for another job.

Four kinds of negatives can be used in offset-plate making:

1. The *dry plate*.
2. The *wet plate*.
3. The *film*, of which several types are available, each designed for some particular need.
4. The *paper*.

Contact negatives can be made by photographing any printed job, such as office forms and letterheads, but photography only produces what has been printed — it cannot improve the work.

Where text matter is to be produced, it must be set in type in the regular way and photographed in order to obtain a negative. It is preferable to set the type in a larger size, perhaps twice that of the finished piece of work, so that the detail will be sharpened when reduced in photographing. The same is true of drawings.

Machines are appearing on the market designed for making proofs of type on cellophane or like substance for the offset printer. These devices are called *photo-composing machines*. They are not yet in general use.

The *vacuum frame* with a registering device is used in plants where the volume of work is not too great. In larger shops the *step-and-repeat* composing machine is used, which is faster.

Should the Printer "Go Offset"?

Progressive printers today are asking many questions regarding the installation of offset machinery: "Should we add this equipment to our shop?" "Can printing be done cheaper by this method?" "Can the men I have now, learn to operate these presses?" The answer to all of these questions lies in the *kind* of job to be printed, the *amount* of the press run, the *amount of illustrations* compared with the *amount of type matter* in the job, and the *type of presses* already in the shop. What the printers decide vitally concerns the schools that furnish apprentices.

On work that is composed of straight type matter, letter-press is cheaper than offset because, in offset, the type matter must be composed anyway and proofed, so that negatives can be made.

On work that consists of long press runs containing many large illustrations, offset is cheaper. The larger the illustrations are, the greater is the saving, because the cost of halftones does not increase in proportion to the size as it does in the manufacture of photoengravings for the letterpress printer.

Often savings are made by having the text matter typewritten — if the job is not retyped, in order to align the right side of the columns. If this retyping is done, then there is little difference in the costs, and a page of text matter is very much more preferred than unevenly spaced typewritten matter. Tariff pages are the exception, as they cost only about one half as much as letterpress when typed, with the rules drawn in by hand. From time to time one sees announcements of new devices to aid the offset printer in making typewritten matter appear as though it is printed from type, but as yet these devices are in their infancy.

Advantages of Offset Over Letterpress

The writer does not expect prejudiced persons in both fields to agree wholly on the following, but generally speaking, offset has the following advantages over letterpress:

1. Greater depth of color, and faithful reproduction of illustrations.
2. Softer, more natural effect of illustrations.
3. Halftones can be reproduced on rough, mat-finished paper, eliminating glare from stock.
4. Higher speeds in printing.
5. Press makeready not required to the extent of letterpress.
6. Impressions of rules do not "show through" the paper, nor do they curl the sheet.
7. Ease of storing plates — no expensive type metal tied up in standing matter.
8. Offset can be done on enameled paper, if such changes are made as reducing the pressure, reducing the water to a minimum, sheets piled in small lots, and a change of ink to a softer quality.

Disadvantages could be listed as:

1. Not as clear or as distinct as letterpress, especially where detail is wanted in halftones and small sizes of type.
2. Offset plates are more easily wrecked than plates on letterpress machines.
3. Skilled help hard to find in the offset field.
4. More trouble in make-up — such as changes after the negative has been made, as in leading of lines, typographical errors, etc.

Stories are often circulated to the effect that little training is necessary for a person to become a competent offset printer. This is not generally true. Highly skilled operators are needed in all offset departments to make money for the plant. There is, however, some transfer of training from letterpress to offset. But surely as much preparation is necessary to make a competent offset pressman as is necessary in making a competent letterpressman.

Books for Further Reading

Cummings, David, *Handbook of Lithography*.

Willy, C. M., *Practical Photo-Lithography*.

Mertle, J. S., *Process Photography and Plate Making*.

Seward, C. A., *Metal Plate Lithography*.

Magazines

which conduct regular departments or occasional articles

The Inland Printer, Chicago, Ill.

Printing, New York, N. Y.

The American Printer, New York, N. Y.

The Printing Industry.

The Graphic Arts Monthly.

Share Your Knowledge Review.

Intelligence and Employability

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A description of how the boy with the low I.Q. may be started out by the school on the road to successful living.

There are boys and groups of boys in our schools today who have been dubbed as unemployable. They are often considered noneducable. The school does not know what to do with them and the statement is made that industry doesn't want them. Technological changes in modern and industrial methods are blamed for this supposed condition.

The individuals and groups referred to are the boys with low intelligence quotients. The school somehow does not seem to be able to meet their problem and is apparently unable to find an outlet for them. It is easy enough to say that these fellows are no good, that they are human junk, and entirely adrift in a modern industrial world.

The fact is that these boys do find their way into employment. Industry has a specific need for them, and it is surprising to learn of the places these boys fill on the job within a few years after they leave school.

I well recall a young lad (I shall call him George Jones) whom I tried to teach in my early experience as an instructor in the La Crosse Vocational School. He was a congenial, smiling chap attending school one day a week. I placed some elementary reading and arithmetic work before him but he did nothing with it and made no attempt to do so. It was a joke to him and he laughed it off. In my experience with this chap I received an education, though the boy did not. I learned in time that George honestly could not read above the second-grade level, that he did not know his multiplication tables, and could do simple addition only with great labor and inaccuracy. He was, therefore, in no position to study any of the seventh- and eighth-grade subjects requiring reading. He could not do ordinary arithmetic problems. George was really a full grown man, seventeen years of age, and weighed 160 pounds. He had been in school all his life. I was an academic teacher with polish. I was unconscious of the fact that George could not do academic work on a seventh-grade level. The boy was wholeheartedly indifferent because he could not do the lessons assigned him and infractious when he was too hard pressed to that end. By the time that I learned that he was limited in his ability, the boy left school.

I met this lad six years later. He stopped me on the street to inquire about courses in the evening Vocational School. He was a journeyman plasterer, a member of the union, and drawing the regular wage of $1.35 an hour. He had served his three years as an apprentice and had passed the journeyman's examination which enabled him to enter the plasterer's union. He was interested in learning to do better in reading blueprints and inquired about vocational evening courses to that end. Incidentally he lamented the fact that he had been too dumb to take the opportunity to learn when as a lad he attended Vocational School. Incidentally I lamented the fact that his teacher had been too dumb to teach him as well as did his fellow tradesmen and plasterers, though I did not tell him so out there on the street.

This is by no means the first nor the last case of this type that I have contacted in my years of experience in vocational education. It is a long time ago now since it was easy for me to say that a certain boy was no good, that he couldn't hold a job, or that he was dumb and unemployable. There are many boys with an I.Q. of somewhere between 65 to 85 who are unsuccessful in the regular academic school. They are unsuccessful also in the high-school industrial-arts courses. The utter impossibility of fitting them into the regular school picture readily enough leads instructors and administrators to chalk these boys up as social problems. They must be cared for somehow. Administrators figure that the boys are better off in school than on the streets or in jail, so their presence is at least tolerated. The doom of these individuals is purely visionary, as anyone may discover if he follows them up a few years after they are out of school. Truly enough the boy has a low I.Q., but the problem lies not in the fact that he is so dumb but rather in the fact that the schools have been too dumb to teach him.

At one time this summer I took my own children to the wading pool in the city park. The thing that usually happens when I go anywhere is that I meet some of our former Vocational School students. On this occasion I met William Blank. He had brought three or four of his children to wade in the pool. He was glad to see me, and no sooner had conversation gotten under way then he began to lament the fact that he paid no attention to his school studies when he went to school. He cared for absolutely nothing in those days, he said, and it would have been much better for him, he reflected, if someone at the school could have possibly driven something into his head. He had a good job, and through the years of depression had never been unemployed. His wages were $120 a month, working for an ice and fuel company. In summer he handled ice and in winter he delivered coal. His working hours were reasonable. He seemed to have only two complaints to make. One was that he didn't learn anything in school, and the other that he had to do hard and heavy work because he didn't learn anything in school. It might have been some comfort to William had I told him of several college graduates I knew who were handling ice and coal for less money than he was getting. This particular chap with an I.Q. of 72 is established in an occupation, and has a family at a time when his former classmates are scarcely out of college.

The La Crosse Vocational School, located in La Crosse, Wisconsin, is in its original conception a part-time school or a school for the out-of-school group, the school for the boy who leaves the classroom at an early age and goes to work. This school recognizes the boy with the low I.Q. as a specific problem and approaches him with the view of working out a solution for him. Special classes are, therefore, organized for students of this type. These are known as opportunity classes, operated on a full-time basis, with instruction organized on a shop order. The classroom is run like a factory, shop, or trade. The boys are turned over to instructors who are shop competent — men who themselves have made good in industry and are considered trade competent by local tradesmen. The boy learns to work, to use tools and machines, to obey orders, to carry out orders, to practice habits of safety and good workmanship. He is trained as a good employee. The standards of work are the same as they are in industry, and the boys learn to become good workmen surprisingly well.

I want to make a statement here, that in the experience of the La Crosse Voca-

tional Schools, employability is not based on intelligence. The La Crosse Vocational Schools give training to adults of every age. Their various instructional groups include part-time, half-time, full-time, and opportunity boys and girls. They give trade finding, trade preparatory, and trade extension training. They conduct a college of commerce for the training of business workers. Nearly half the day-school students are high-school and college graduates. Several groups are made up entirely of opportunity students. The adult evening schools enroll over 4,000 persons a year. The individual enrolled may have an I.Q. of 65 or 135. He may be unable to read or he may hold a college degree. In any event, the objective of his training is employment. He remains in school until he gets a job. He attends school part-time, day or evening, to advance on the job. He gets no diploma — he gets employment. For that reason the school conducts a placement department, and every instructor is considered a member of the placement staff. The experience of this staff verifies the statement that employability is based not upon intelligence but upon attitude. The boy with good characteristics, the boy who wants to work, who obeys orders, and does the thing that the boss wants done is employable regardless of intelligence. On the other hand, the individual with no workmanlike attitude is not an employable individual regardless of the magnitude of his I.Q. Good workmanlike attitudes, ability to obey orders, or in other words, adaptability to the job are, therefore, most important training features of the La Crosse Vocational Schools.

The boy with an I.Q. of 80 or less is an individual who will have little success in learning in the regular academic high school and college setup, and it is futile to attempt to steer him that way. Any effort to force such training upon him must call upon all his native resources for resistance and protection. Some individuals may be placid enough to sit through it uncomplainingly as long as possible. Others will rebel early, and some will go out of adjustment with the whole scheme of society before they mature.

In earlier years this chap was not a problem because he found his way out of school early enough. Present-day compulsory-attendance laws, child-labor laws, and longer periods of school training, however, keep him definitely in the school and he presents a problem for which the regular high school, in general, has set up no machinery of solution.

One of these boys with an I.Q. of 81 was placed in an automobile repair shop in 1927. He is still working in this same job for the same employer, and he never lost more than two weeks of work in that period. He remained on the job during the depression when every other mechanic was laid off. He is not a mechanic himself, not having the intellectual urge to rise to the finer points of automobile mechanics. He does not care to overhaul an automobile. He prefers to wash and grease cars and do all the other types of service work. Briefly, he is indispensable to his employer because he fills an important niche. This is a case of a satisfied worker and a satisfied employer. It is an illustration of the fact that there is a definite need for good workers — for good boys who will be satisfied to do ordinary service or routine work. There is an overabundance of that type of work to be done in our modern industrial system, and employers definitely want the men who will be satisfied to stick to this type of job. This individual in the garage is well placed. It would have been a mistake to have placed him on a higher level. It would be an equally great mistake to place a high-type individual on an ordinary type of job unless the promotional road were open.

An individual with a managerial mind and ability will not remain long at routine work. For that reason the placement staff of the La Crosse Vocational School may go first to the low I.Q. group to seek the best boys for certain jobs. Placement, however, is not conducted on the basis of a definite I.Q. leved for a definite type job. The contrary is true. For example, an individual may become a successful carpenter on practically any I.Q. level from about 65 to 135. In fact so wide a range of intelligence is a condition that actually exists in the trades and in jobs and occupations generally. We have professional people also on varying I.Q. levels. Individuals from the low I.Q. groups do not, of course, become doctors or lawyers. They never get through college in the first place. They do, however, vary considerably in intellectuality.

After all, the I.Q. rating is quite specifically a determiner of the probable success of an individual in college life. College placement is logically based upon an I.Q. Employability is based on attitude or character. Accordingly as the individual varies in his attitude and general character or characteristics, so will he vary in his employability and consideration for varying jobs and occupations. Different types of boys call for placement in different types of jobs and training specifically for these jobs. The La Crosse Vocational Schools, in approaching the problem from that angle, experience no special difficulty in placing in employment the individual with the low I.Q.

Auto Economics

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An outline of a course and a final test to be given at the end of the course.

The one-half unit course in automobile economics described herewith has been offered at our school since February, 1936. The course is an elective for girls and boys who have not had the regular course in automobile construction. The class meets one period per day, five days per week, with lectures, demonstrations, class reports, discussions, and examinations. Laboratory periods are conducted whenever necessary for efficient instruction.

The course includes such subjects as the history of transportation, sociological changes brought about by the automobile, mechanics and construction of the automobile, cost of ownership and operation, occupational opportunities and safe driving.

Automobile Economics

History of Land Transportation

1. Travois, carts, wains, and wagons.
2. Mechanical development illustrated by the bicycle.
3. Roads and early coach transportation.
4. Steam and rail transportation.
5. Invention of the internal-combustion engine.
6. Early experiments and pioneers.
7. Development of the automobile.
8. Fuels, oils, alloys, rubber, etc.
9. Good roads, high speeds, present traffic conditions.
10. Lack of balance in control and safety.

Social Changes Caused by the Automobile

1. Extent of the automobile industry.
2. Sources of labor supply.
3. Mass production, labor organizations.
4. Displacement of the horse in city and on farm.
5. Effect on farm production and surplus.
6. Effect on community life, rural and urban.
7. Competition with the railroads.
8. Taxation and regulation.

Construction of the Automobile

1. Essential features of the automobile:

a) Power to propel the vehicle.
b) The frame or chassis.
c) Proper housing for passengers or cargo.
d) Proper methods of absorbing road shocks.
e) Controls for starting, steering, stopping.
2. Detail parts concerned in each of above functions.
3. Trade terms and names of each part.
4. Troubles, their detection and remedy.

Mechanics of the Automobile
1. Production of power:
a) Compression; the four-stroke cycle.
b) Carburetion.
c) Ignition.
d) Lubrication.
e) Cooling.
2. Transmission of power.
3. Application of power.
4. Steering the car.
5. Lighting the way.

Engineering Methods in the Automobile Field
1. Interpretation of engineering and design.
2. Engineering objectives in this field:
a) Performance.
b) Appearance.
c) Economy.
d) Safety.
3. Research applied to design and materials:
a) Combustion, vibration, transmission, balance, strength.
b) Fuels, oils, alloys, rubber, finish.
4. Breakdown, testing, proving, racing.

Industries Allied to the Automobile
1. Manufacture of the car itself.
2. Distribution of the automobile.
3. Manufacture and distribution of parts and accessories.
4. Mining of iron, copper, nickel, aluminum, etc.
5. Smelting, refining, and alloying of metals.
6. Casting, forging, machining, stamping, pressing, forming.
7. Garage servicing for parts and repairs.
8. Rubber production, manufacture, and distribution.
9. Fuel and oil production, refinement, and distribution.
10. Road building and maintenance.

Occupational Opportunities and Requirements
1. Commercial or selling occupations:
a) Car salesman, dealer, distributor, jobber.
b) Accessory salesman, dealer, wholesaler.
c) Oil and gas salesman, dealer, distributor.
d) Salesman for equipment, insurance, etc.
2. Industrial or labor occupations:
a) Factory worker, foreman, engineer, manager.
b) Miner, farmer, railroader, sailor, machinist, mechanic.
c) Chauffeur, truck driver, garage man.
d) Oil-field workers.

Ownership of an Automobile
1. Selection and purchase:
a) Price level.
b) New or second hand.
c) Cash or time finance.
2. Housing, care, and repair.
3. Mileage costs.
4. Maintenance costs.
5. Insurance.

Driving an Automobile
1. The driver:
a) Qualification, vision, reaction time.
b) Mental and emotional limitations.
c) Effect of alcohol.
2. The car:
a) Weight, speed, momentum.
b) Acceleration and breaking power.
3. Traffic conditions.
4. The highway.

Traffic Control
1. Rules of the road.
2. State laws.
3. Local ordinances.
4. Inspection and license.
5. Road patrol.

Touring by Automobile
1. Planning a trip.
2. Sources of information.
3. Services of automobile clubs.
4. Reading and following a road map.

Examination Given at End of Course

The examination consists of three parts. Answer *all three*, carefully following the directions for each part.

Part I

DIRECTIONS: The following is known as a multiple-choice test. One of the suggested answers is correct. Underline the correct answer and place its number in the parentheses ( ) at the right of the question.

SAMPLE: The inlet and exhaust of vapors from the combustion chamber is controlled by: (1) manifolds; (2) valves; (3) water jackets; (4) accelerator. (2)

1. The ratio between the speeds of a crankshaft and camshaft is: (1) 1:1; (2) 2:1; (3) 5:1; (4) 20:1. ( )

2. A motor having a compression ratio of 7:1 has a: (1) high compression ratio; (2) low compression ratio. ( )

3. The power produced in the combustion chamber is directly applied to the: (1) valve; (2) camshaft; (3) piston; (4) cylinder wall. ( )

4. A motor which has all the valves on the same side of the cylinders and in the block is called: (1) T; (2) I; (3) L; (4) F. ( )

5. The distance which a piston travels in a cylinder is called: (1) bore; (2) throw; (3) stroke. ( )

6. Pistons are assembled to connecting rods by: (1) journals; (2) wrist pins; (3) rings; (4) studs.

7. Leaking piston rings are often indicated by: (1) excessive use of oil; (2) noisy tappets; (3) a knock in the motor. ( )

8. The part of a motor which transmits the power from the piston to the crankshaft is a: (1) push rod; (2) connecting rod; (3) sleeve rod; (4) crank arm. ( )

9. Burned gases are carried away from the combustion chamber by: (1) fuel lines; (2) intake manifold; (3) breather pipe; (4) exhaust manifold. ( )

10. Fans are used to cool the motor by: (1) Sucking air through the radiator; (2) Blowing air over the motor; (3) Blowing air through the crankcase. ( )

11. In a battery ignition system the battery voltage is increased by the: (1) spark coil; (2) condenser; (3) voltage regulator; (4) coil. ( )

12. The most economical gasoline-air ratio in pounds for use in present-day motor cars is: (1) 12:1; (2) 16:1; (3) 18:1; (4) 20:1. ( )

13. The main bearings in a motor are used to hold the: (1) drive shaft; (2) clutch shaft; (3) camshaft; (4) crankshaft. ( )

14. The driving section of a clutch is the: (1) crankshaft; (2) flywheel; (3) friction plate; (4) throw-out collar. ( )

15. The driven section of a clutch is the: (1) crankshaft; (2) flywheel; (3) friction plate; (4) throw-out collar. ( )

16. Poppet valves are forced open by the (1) valve spring; (2) camshaft; (3) crankshaft; (4) sleeve rods. ( )

17. To automatically crank a motor a starter gear is engaged with the: (1) timing gears; (2) clutch shaft; (3) crankshaft; (4) flywheel. ( )

18. The combustible mixture burned in a motor is mixed by the: (1) vacuum tank; (2) fuel pump; (3) oil pump; (4) carburetor. ( )

19. The type of transmission in universal use today is: (1) friction disk; (2) planetary; (3) progressive sliding gear; (4) selective sliding gear. ( )

20. Most clutch troubles are caused by: (1) riding the clutch; (3) racing the motor; (3) lack of lubrication; (4) improper shifting. ( )

21. Power is transmitted from the drive shaft to the gear ring by the: (1) pinion gear; (2) axle gear; (3) spider gear; (4) timing gear. ( )

22. In a Hotchkiss drive the torque or twisting effort is taken up by the: (1) torque tube; (2) radius rods; (3) rear springs; (4) axle housing. ( )

23. A rear axle which supports the weight of the rear wheel and exerts the driving effort is a: (1) full-floating axle; (2) three-quarter floating axle; (3) semifloating axle; (4) dead axle.

24. The number of times that 28 x 5 tire will turn over in a mile is: (1) 250; (2) 648; (3) 720; (4) 956. ( )

25. Master and wheel cylinders are important parts of: (1) mechanical brakes; (2) hydraulic brakes; (3) vacuum booster brakes; (4) air brakes. ( )

26. Rear springs which are mounted parallel to the frame of the car are: (1) cantilever; (2) platform; (3) cross; (4) longitudinal. ( )

27. The steering rod which connects the two steering arms is a: (1) drag rod; (2) drag link; (3) tie rod; (4) radius rod. ( )

28. A spindle is part of a: (1) ball-and-socket joint; (2) knuckle; (3) steering gear; (4) steering arm. ( )

29. Of the potential power in a gallon of gasoline, the per cent used in actually turning the wheel is: (1) 8 per cent; (2) 32 per cent; (3) 65 per cent; (4) 89 per cent. ( )

30. The amount the driver turns the steering wheel in relation to the amount the pitman arm moves is: (1) steering geometry; (2) camber; (3) Ackerman principle; (4) steering ratio. ( )

31. In driving on the open highway under normal conditions it is best to allow the car preceding you to stay ahead: (1) one car length; (2) two car lengths; (3) four car lengths; (4) eight car lengths. ( )

32. On the average, how much more serious is a head-on collision between two cars each going at 60 miles per hour, than a similar collision when each car is moving at 30 miles per hour? (1) no difference; (2) twice as great; (3) four times as great; (4) eight times as great. ( )

33. In driving a car you approach an intersection at approximately the same time as a car on your right traveling on a cross street. If neither of the streets are through streets, who has the right of way? (1) You have; (2) the other driver has; (3) neither of you; (4) you have if you are going faster. ( )

34. Night driving demands special attention and caution because: (1) driver may fall asleep; (2) more traffic; (3) poor visibility; (4) roads become slippery. ( )

35. Under perfect conditions the shortest distance in which a car traveling at 40 miles per hour may be stopped is about: (1) 40 feet; (2) 78 feet; (3) 115 feet; (4) 200 feet. ( )

36. In crossing a street the safest procedure to follow is: (1) cross anywhere, but be careful; (2) go straight across, never diagonally; (3) cross from between parked cars; (4) cross at corners, but only after looking to see that the way is clear. ( )

37. In entering a through street from a cross street you must first: (1) shift into second gear, then proceed; (2) slow down, proceed if no cars are coming; (3) coming to a complete stop, proceed when safe; (4) come to a full stop, proceed immediately as you have the right of way. ( )

38. If the car you are driving starts to skid to the right: (1) depress both clutch and brake pedals at once; (2) leave clutch in, do not touch brake, let up on gas, turn wheels to the left; (3) leave clutch in, do not touch brakes, let up on gas, turn wheels to right; (4) step on gas, turn wheels to the left. ( )

39. In approaching an intersection where there is no traffic light or traffic officer there is a person walking across in a crosswalk, directly in your path. Who has the right of way? (1) The driver of the car; (2) the pedestrian; (3) neither; (4) the driver if he blows his horn. ( )

40. In walking along an open highway it is necessary to: (1) walk on the side of the road facing oncoming cars; (2) walk on the side of the road with your back to approaching cars; (3) walk on either side. ( )

Part II

DIRECTIONS: The following is known as a completion test. Fill in the blank spaces with the word or words necessary to make the statements complete and correct.

SAMPLE: The self-starter was invented by Charles Kettering.

1. The principle upon which present-day transmissions operate is ———.

2. The four strokes of the four-stroke-cycle internal-combustion engine are: (1) ———; (2) ———; (3) ———; (4) ———.

3. The gears in a differential which allow one rear wheel to go faster than the other when turning a corner are ———.

4. A venturi tube is a very important part of the ———.

5. The unit of a battery ignition system which sends an electrical impulse to the right cylinder at the right time is a ———.

6. The unit of a car which produces electrical current when the motor is running is a ———.

7. List an advantage and disadvantage of mechanical and hydraulic brakes.

	Mechanical	*Hydraulic*
Adv.		
Disadv.		

8. The mounting of front wheels so that the line of weight hits the road ahead of the point of wheel contact is called ———.

9. Force-feed fuel systems employ a ——— to keep the carburetor supplied with gasoline.

10. ——— is the scientific principle upon which all brakes operate.

11. The invention of the ——— was one of the most fundamental and important steps in the development of the auto.

12. A ——— is a device used by automotive engineers to study what is happening in rapidly moving parts.

13. Name five men outstanding in the development of the automobile and give a contribution of each.

	Men	*Contribution*
1.		
2.		
3.		
4.		
5.		

18. List five important factors to be considered in the engineering and designing of a car.

1. ———
2. ———
3. ———
4. ———
5. ———

23. List five phases of society which the automobile has definitely influenced.

Example: community life.

1. ———
2. ———
3. ———
4. ———
5. ———

28. ——— is the process discovered by Goodyear which makes the manufacture of rubber articles possible.

29. The worst enemy of automobile tires is ———.

30. The great rubber plantations of today are found in ———.

31. A ——— is produced by pouring molten metal into a sand mold.

32. An ——— is a mixture of two or more metals mixed or blended together to form a third metal which generally assumes the characteristics of the component elements.

33. ——— designates the anti-knock value of any given gasoline.

34. ——— insurance protects a car owner if he should be involved in an accident resulting in injury to a person or persons or the damage of property.

35. List three important effects of intoxicating liquors upon a driver of an automobile.

1. ———
2. ———
3. ———

38. List three common causes of fatigue in motoring.

1. ———
2. ———
3. ———

Part III

DIRECTIONS: Select any two of the following topics and discuss. Write at least 200 words on each of the two topics selected. Use paper furnished by the examiner.

1. The effect of the automobile on community life, rural and urban.
2. Driver responsibilities.
3. A plan of car ownership including factors involved in both purchase and maintenance.
4. The automobile of the future.
5. Planning a trip by automobile.

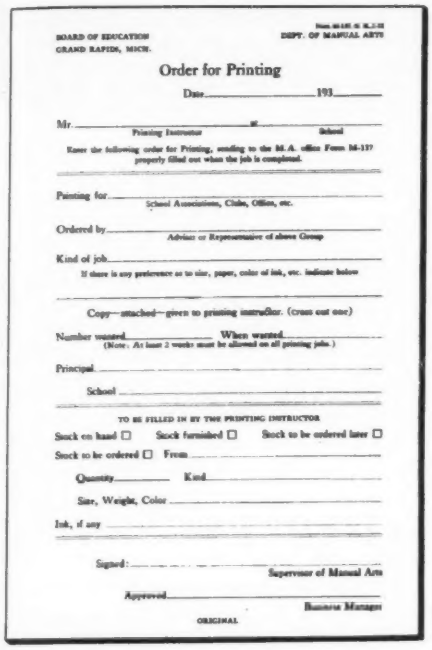
Controlling Production Work

Harry P. Buboltz

Ottawa Hills High School,
Grand Rapids, Michigan

The writer has solved the troublesome question of how to control production work in his school printshop.

Production work in any school printshop always presents a problem that must be coped with in some manner. The ideal condition is not a shop that does *no* practical work but one which *can control* its production work in such a way that the right kind of work comes into the course at the proper time. While this is done to a large degree in producing the school blanks and forms at the Ottawa Hills High School, Grand Rapids, Mich., the type of work that causes inconvenience is tickets, posters, programs, and the like that are produced for organizations connected with the school. Since the officers of some of these organizations, seemingly did not understand the



BOARD OF EDUCATION
GRAND RAPIDS, MICH.

DEPT. OF MANUAL ARTS

Order for Printing

Date _____ 193_____

Mr. _____ Printing Instructor _____ at _____ School

Enter the following order for Printing, sending to the M.A. office Form M-137 properly filled out when the job is completed.

Printing for _____ School Associations, Clubs, Offices, etc.

Ordered by _____ Advisor or Representative of above Group

Kind of job _____

If there is any preference as to size, paper, color of ink, etc. indicate below

Copy—attached—given to printing instructor. (cross out one)

Number wanted _____ When wanted _____

(Note: At least 2 weeks must be allowed on all printing jobs.)

Principal _____

School _____

TO BE FILLED IN BY THE PRINTING INSTRUCTOR

Stock on hand ☐ Stock furnished ☐ Stock to be ordered later ☐

Stock to be ordered ☐ From _____

Quantity _____ Kind _____

Size, Weight, Color _____

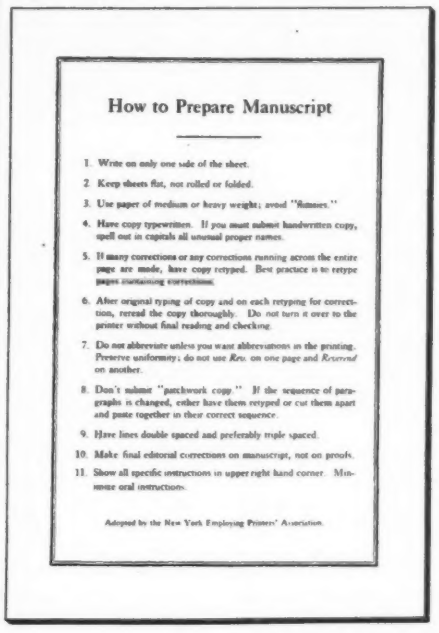
Ink, if any _____

Signed: _____ Supervisor of Manual Arts

Approved _____ Business Manager

ORIGINAL

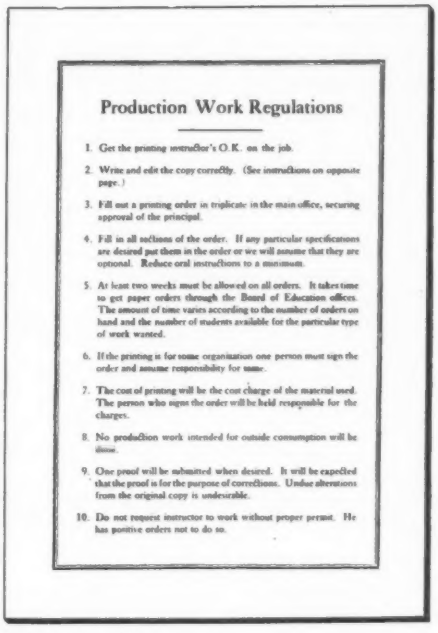
Fig. 1. Order form



How to Prepare Manuscript

1. Write on only one side of the sheet.
2. Keep sheets flat, not rolled or folded.
3. Use paper of medium or heavy weight; avoid "flimsies."
4. Have copy typewritten. If you must submit handwritten copy, spell out in capitals all unusual proper names.
5. If many corrections or any corrections running across the entire page are made, have copy retyped. Best practice is to retype pages containing corrections.
6. After original typing of copy and on each retyping for correction, reread the copy thoroughly. Do not turn it over to the printer without final reading and checking.
7. Do not abbreviate unless you want abbreviations in the printing. Preserve uniformity; do not use *Rev.* on one page and *Reverend* on another.
8. Don't submit "patchwork copy." If the sequence of paragraphs is changed, either have them retyped or cut them apart and paste together in their correct sequence.
9. Have lines double spaced and preferably triple spaced.
10. Make final editorial corrections on manuscript, not on proofs.
11. Show all specific instructions in upper right hand corner. Minimize oral instructions.

Adopted by the New York Employing Printers' Association.



Production Work Regulations

1. Get the printing instructor's O.K. on the job.
2. Write and edit the copy correctly. (See instructions on opposite page.)
3. Fill out a printing order in triplicate in the main office, securing approval of the principal.
4. Fill in all sections of the order. If any particular specifications are desired put them in the order or we will assume that they are optional. Reduce oral instructions to a minimum.
5. At least two weeks must be allowed on all orders. It takes time to get paper orders through the Board of Education offices. The amount of time varies according to the number of orders on hand and the number of students available for the particular type of work wanted.
6. If the printing is for some organization one person must sign the order and assume responsibility for same.
7. The cost of printing will be the cost charge of the material used. The person who signs the order will be held responsible for the charges.
8. No production work intended for outside consumption will be done.
9. One proof will be submitted when desired. It will be expected that the proof is for the purpose of corrections. Undue alterations from the original copy is undesirable.
10. Do not request instructor to work without proper permit. He has positive orders not to do so.

Fig. 2. Pages 2 and 3 of pamphlet

purpose nor the procedure of the school printshop, definite rules were established relative to the kind of work that could be produced and the time necessary to complete them. This in itself was not enough, so a small pamphlet was prepared that explained the manner in which copy should be prepared, the rules governing the use of the shop, and the manner in which orders should be entered.

It is impossible to control production work if anyone in the school building is permitted to come directly to the printshop and order any printing they desire. In schools where the teaching time of the instructor takes up the entire school day, it is impossible for him to make explanations to all who come in to enter orders. For this reason, it is necessary to insist that orders be entered in the school office. From here the order is routed to the director of manual arts who then checks up on how busy the various school printshops are and where the work will fit into the program. He also sees that the job handed in conforms to the rules set down in the book of instructions shown in Figure 2. This may seem a rather lengthy process but it keeps out all orders that should not be produced in the school shop. It does not hinder the production of the job because this time is utilized to get delivery of the paper required for the job. Oral instructions on these printing jobs are not permitted, and the order blanks are carefully scanned to make sure that they carry all the information necessary so that the job may be produced without delay. The order blank used in the Grand Rapids schools is shown in Figure 1.

The pamphlets on "Instructions for Production Printing" are available to all teachers and students who want to enter printing orders. This pamphlet was prepared to aid those persons or organizations directly connected with the school, who desire printing which is done as *production work* in conjunction with the *theoretic work* at the school printshop.

It has obviated many misunderstandings with teachers and organizations because it gives all the information needed as to the procedure in the school printshop. The alibi that "I didn't know that the school printshop needs more time to produce a job than a commercial shop" is, therefore, out of order. The pamphlet has been so successful at the Ottawa Hills High School that the other high schools of the city also have adopted it for use in their manual-arts department. The pamphlet used and the material presented is illustrated in Figure 2.

It has been found that production work controlled in the manner set forth is much easier to handle in the school shop and is more satisfactory to the school authorities.

A Dictionary Test

Richard M. Bell

Leonia, New Jersey

*A method of ascertaining whether the student actually uses the "Dictionary of Technical Terms."**

Part I

DIRECTIONS: Read the following questions carefully. Then write the answers to the first part from memory as briefly and as definitely as possible. The answers to the second part must be written as you refer to the dictionary.

1. Where are the guide words in this dictionary located? ———

2. How many guide words are there on each page of this dictionary? ———

3. Which words are used as the guide words? ———

4. What indication is given in this dictionary, of the field of work in which any given word belongs? ———

5. Are there any abbreviations used in this dictionary? ——— If so, is there a table of abbreviations? ——— If not, should there be a table of abbreviations? ———

6. Does this dictionary attempt to include all the "technical terms" in any particular field? ——— Give your reason for this answer ———

7. Is there an italicized abbreviation after each word? ———

8. How do you tell when the same word

*Published by the Bruce Publishing Company, Milwaukee, Wis.

applies in more than one field of work? ———

Part II

Refer to your *Dictionary of Technical Terms* and answer these questions.

1. What is dragon's blood? ——— List the properties of this material? ———

2. What is an acanthus? ——— Where would it be of most use? ——— Which class of workers would meet this word most often? ———

3. What is the accepted definition for these items? Number each word with the number of fields in which it is used.

a) draft	*d*) malax	*h*) brake shoe
b) drift	*e*) pica	*i*) tang
c) indenture	*f*) shim	*j*) kiln
	g) pestle	

4. What is the definition of the last word beginning with *Y*? ——— How many words are there in this dictionary beginning with *X*? ——— *Z*? ———

5. Some words which sound like slang have a very definite meaning in the shop. Define the following as examples.

a) belly	*d*) swab	*g*) dope
b) hellbox	*e*) half nut	*h*) bat
c) bastard	*f*) rod	*i*) dog

6. Arrange the following words alphabetically: kilowatt, incandescent, rustication, kilowatt hour, burr, alternator, increment, taximeter, rough cast, numismatics, spacious, rough cut, draw bolt, thermite, kerf, ammonia, kinetic, drawknife, alum, drill, glazed, negative, commutator, comparator, glass, plate.

7. Now, compare your arrangement with the arrangement in the dictionary. Did you make any mistakes? If so, how did they occur? Write your explanation in the space below.

8. How many fields of work are included in the *Dictionary of Technical Terms*? ———

9. List the fields of work pictured on the front cover of the *Dictionary of Technical Terms*.

10. How many editions of this book have been printed? ———

Survey of the Neon-Sign Industry

Abraham Diamond

New York City, New York

One of the newer types of industries which is demanding recognition from the vocational educators in the larger cities.

The Gompers High School in the city of New York was recently opened to give vocational education in the automotive and electrical industrial fields. Among the several specialty courses in electrical practice is Neon-light work. The question may arise in the minds of educators, of manufacturers, and workers in the industry, and of public-minded citizens in the metropolitan area, "What good will be accomplished by training boys for Neon-sign work?" How will this course fit into our vocational-training program? What employment opportunities are there for boys after they have received training in the Neon-sign course?

This survey shall attempt to find the answers to these questions objectively and without bias. For an intelligent understanding of the subject, the history of manufacture will be traced briefly, to be followed by a description of trade practice and breakdown of labor. Since making a living today is quite often the adaptation of the trained mechanic to other trades, there will be a short discussion concerning related industries. The survey will continue with employment statistics, offering a possible indication of employment opportunities and will conclude with a course of study, plan for a shop, and list of equipment and supplies for efficient operation.

History

In the field of electrical conductivity and related phenomena, much work had already been done on solids and liquids, when the possibilities of the third phase of matter, namely, gases, were still an unknown quantity. The first important experiments were those of Crookes with what is known as the Geissler tube. Later came the work of Roentgen (X-rays) and J. J. Thomson, and many others, which, together with the work on radioactivity, has culminated in the new physics. None of our knowledge of subatomic phenomena, such as the concept of the electron, would have been possible without this foundation. As part of this particularized research came the discovery of the rare gases in about 1895 by Lord Rayleigh, Ramsay, and Travers, in England.

Always following in the steps of research, physicists and chemists whose objects are purely theoretical, are another group of men who try to adapt theory to everyday life. Among these are the engineers, one of whom, D. McFarlan Moore, developed a lamp or tube known by his name. This lamp used carbon dioxide or nitrogen as the conducting medium. It was not very successful commercially (1910).

In 1917, Georges Claude, a French engineer who had developed the Claude process for the liquefaction of air, received a basic patent on a Neon tube in which he combined already available knowledge into a successfully operating tube of long life. Auxiliary equipment necessary for Neon-tube operation began to be developed, but it was really not until 1925 that gaseous conductivity was commercially exploited to any extent in sign work. There followed an evolution of the industry that was slow for the reason that the necessary technical knowledge was limited to a very few vacuum-tube manufacturers and laboratory engineers, and to the strenuous prosecution for patent infringement by the Claude companies.

However, when noninfringing electrodes were developed, and to a much greater degree after the expiration of the patent in 1932, the growth of the industry was extremely rapid. When one considers that the industry has been growing at a rapid rate during a period of economic depression, it is quite obvious that there will be a phenomenal development after recovery. The logical conclusion is, of course, that employment opportunities will be multiplied at a rapidly increasing rate.

Trade Practice and Breakdown of Labor

The usual Neon-sign organization is divided into sales, office, production, and maintenance departments. The art department may be another one or it may be part of office or production departments. In some cases, it is directly connected with the sales organization, but then another art subdivision is necessary for layout work in the production department.

Since any discussion concerning the relative importance of any of these departments would be as futile as the classic argument of the stomach and the legs, these divisions of the industry will be discussed in what from the business viewpoint may be termed chronological order.

Most Neon signs, except standard portable window displays, are built to order on a contract basis. Therefore, the

(Continued on page 220)

INDUSTRIAL ARTS and VOCATIONAL EDUCATION
J. J. Metz, Editor

The Thermometer and its Inventors

Most students of industrial arts and vocational education are interested in the thermometer because temperature in many cases plays an important role in industrial work. A brief history of the thermometer, its development, and a résumè of the lives of the men who invented and perfected it may not be without value for the boys in the school shop, whether on the industrial arts or on the vocational level. It may be well to emphasize that the thermometer measures not the quantity, but the intensity of heat. The action of this measuring instrument is based on the fact that most bodies expand with rising temperatures and contract as the temperature falls.

Galileo is credited with having made an air thermometer in 1593. Since the atmospheric pressure affected the readings, however, this thermometer did not find much favor. In 1612, he invented a thermometer in which a liquid, probably alcohol, was hermetically sealed in a tube, very much as is done in the thermometer of today. The scale used by Galileo was in degrees, each of which represented one thousandth of the volume of the thermometer bulb. However, a fixed zero point from which to read the scale was lacking. It is claimed that in 1641, Grand Duke Ferdinand of Tuscany made a thermometer using a liquid.

Isaac Newton, in 1701, proposed to make the freezing temperature of water the zero point on the thermometer scale, and that the normal temperature of the human body be designated as twelve degrees.

In 1709, Gabriel Daniel Fahrenheit actually made such a scale, and applied it to an alcohol thermometer of the type now in common use, but he established his zero point at the lowest temperature which he could obtain by making a freezing mixture of ice and salt. He divided the distance between this zero point and the point established on his scale by the temperature of the human body into twelve degrees, but later divided each one of these divisions into eight parts, calling each a degree. In other words, on his scale, the temperature of the human body was marked as 96 degrees. He later demonstrated that the freezing point of water and the temperature of boiling water were practically constant. Based on his original scale, the freezing point of water was located at thirty-two degrees, and the boiling point at two hundred and twelve degrees, thus dividing the scale between these two points into one hundred and eighty degrees.

After the freezing and boiling points of water had been adopted as the fixed points, other scientists began to propose different thermometer scales. René Antoine Ferchault de Reaumur, for instance, constructed his thermometer, taking the freezing point of water as the zero mark, and then graduating the rest of the tube into degrees, each of which was one thousandth of the volume contained in the bulb and tube of the thermometer up to the zero mark. In this way, when he located his boiling point, he found it opposite the eighty-degree mark. The use of his thermometer scale, which was introduced in 1731, has gradually declined.

In 1742, Anders Celsius devised still another scale. He took the freezing point and the boiling point of water as the fixed points on his thermometer, taking the former as the zero point and giving the latter the value of 100 degrees, in other words, dividing the space between the freezing and boiling points into one hundred equal divisions. From this his scale is commonly known as the centigrade scale. The Fahrenheit and the centigrade scales are still commonly used, the first one for reading and recording weather temperatures, the second one in recording the temperatures in most scientific work.

Space forbids more than a mere glimpse into the lives of the scientists to whom we owe the thermometer. Galileo was born at Pisa in 1564. He attended the University of that city and studied medicine. It was in the cathedral at Pisa that the swinging of the sanctuary lamp gave him the idea from which he later developed the laws of the pendulum. Lack of money forced him to leave the university, but he kept on privately with his mathematical studies. It was during this period of his life that he invented the method of determining specific gravity which is still used. In 1589, because of his achievements, he was made professor of mathematics at Pisa. During the two years of his stay at this school, he worked out the laws of falling bodies. In 1592 he lectured on mathematics in the University of Padua. Here he remained for eighteen years. During this time, he did much to improve the telescope. With one of these instruments made by himself, he carried on extensive astronomical studies which led to important discoveries. He died at Florence in 1642, where his body is buried in the cathedral of Santa Croce.

Gabriel Daniel Fahrenheit was born at Danzig on May 14, 1686. He spent a great part of his life in England and Holland, making meteorological instruments. He was an earnest student of physics, and besides improving the construction of thermometers and the invention of the thermometric scale which still bears his name, he also is known as the inventor of an improved hygrometer. He died in Holland on September 16, 1736.

René Antoine Reaumur was born on February 28, 1683, at La Rochelle, France. He attended the Jesuit College at Poitiers. After studying law and mathematics at Bourges, he went to Paris to continue his study of mathematics and physics. He was elected a member of the Academie des Sciences at the age of 24. He is noted for voluminous scientific writing, and making important discoveries in the manipulation of iron and steel. While he was of a retiring disposition, the government, nevertheless, placed many duties on his shoulders, most of which he performed with great diligence and exactness, although he refused to accept any salary for his work. Besides the thermometer scale which still bears his name, he is noted for his many writings on natural history, mathematics, and other branches of science.

Anders Celsius was born in Upsala, Sweden, on November 27, 1701. He was appointed to the chair of astronomy at the University of Upsala, Sweden, in 1730 and occupied it for 14 years. He made extensive trips through Germany, Italy, and France. In 1738, he was appointed by the French Academy to the expedition which was sent to Lapland for the purpose of measuring an arc of the meridian. Besides being the inventor of the thermometer scale already mentioned, he is noted as an astronomer and as a writer of many important scientific works. He died in his native city on April 25, 1744.

Each one of these men possessed a deep interest in science and its application to human needs, courage to try the new, energy to study and work, and above all, the virtue of perseverance. They are worthy examples to be held to the students in industrial arts and vocational education.

NEON-SIGN INDUSTRY

(Continued from page 218)

first thing to do is to sell the sign. This involves on the part of the salesman, and particularly of the sales manager, possession of considerable technical knowledge. He must, for instance, be able to determine what type of sign will be suitable in a given locality, what its visible effect will be, what size the sign and letters should have, and so on. He must be acquainted with building-department regulations; he must be able to approximate the cost of the sign, and in order to do this, must know how to estimate the length of tubing, the number of transformers needed, the cost of sheet-metal work, the sign painting or porcelain-enamel work to be done, the cost of installation and of such auxiliary equipment as rotary converters, time switches, flashers, and animators. From transformer data, he must be able to determine current consumption and cost of operation. As a sales stimulus and timesaver, he should be able to draw a fairly good sketch of his idea of the display for the prospective customer. This is a condensed summary of the abilities that are required by the Neon-sign salesman. The conclusion is obvious — a technical product requires technically trained salesmen.

The office must have one or more persons trained technically for the Neon industry. Receiving and routing of maintenance calls and giving sales and production information are part of the duties which fall to the person who has to answer the telephone in the Neon-sign industry. Applications must be made out and filled with the various municipal bureaus for permits and with the Fire Underwriters for certificates of approval. There must be someone who is able to estimate exactly on specifications. Purchase of materials must be in the hands of a trained person. Finally, a very important phase of office activity is the makeup of work orders based on closed contracts.

After specifications have been carefully checked, including the possibility of sending a man to the location for a check on building dimensions, actual work commences on production. The man in charge of production should have a complete training in all phases of the industry. In extreme cases he should be able to fill in and take the place of anybody in the organization. He must, of course, be a capable executive.

The first step in production is the making of the layout of the sign. This consists of making a full-size outline drawing of the sign, letters, and decorative effects. Heavy kraft paper is generally used for the layout. The tubes are then drawn and are traced in reverse on sheet asbestos. A fairly close limit of accuracy is demanded. This work is done by a draftsman, sign painter, or sketch artist. Upon completion, the production manager adds the wiring diagram, and information relating to tubing, transformers, electrodes, and the like.

The asbestos layout is turned over to the glassblowers, and the kraft-paper layout to the sheet-metal workers, so that both departments can work simultaneously on the job. Quite frequently, however, porcelain-enamel faces may be required, and in this event the kraft-paper layout is first sent to the enameling factory before the sheet-metal work is begun. The layout may also call for raised metal letters, channels, decorations, and so on. The general procedure is to make one of the faces, the attached framework and the angle-iron assembly but not to close the sign box with the other face until practically all the wiring is completed by the electricians.

Meanwhile, as stated, the glass work is going on. The glassblower is a highly skilled mechanic who takes tubing of the correct color and diameter, heats it, and bends it according to the pattern appearing on the asbestos layout. He bends up the ends, attaches the electrodes, and makes a tubulation which is later attached to the evacuation unit. The glassblower must be able to work with several types of glass, make such apparatus repairs as are necessary and in some cases make the apparatus itself.

The next step is the processing of the tubing. This is the job of the pump man. He usually does not have the skill of the glassblower in working with glass, but must have considerable ability in this field. He has to attach the tubing units to the exhaust manifold, to seal or tip off the unit after filling and to repair any leaks in the tubing as well as to remove and seal on the glass containers of rare gases. He must know how to evacuate, bombard, and fill the tubes and age them. Besides he should be acquainted with the operation of the high vacuum pump, and aspirator, and the bombarding transformer and its auxiliary equipment.

While the tubing is being made and processed, and after the sign box is partially complete, it is the work of the electricians to install the electrode housings, cleats, tube supports, transformers and the high- and low-tension wiring. Later he must attach the tubing to the housing terminals and fasten it to the tube supports. He must be a trained electrical worker, know the city and Fire Underwriters codes, and be able to solve any problems that may arise in conjunction with the transformer, flasher, animator, time switch, rotary converter, and starter operation. A very important phase of the electrician's activity is in the installation of indoor "skeleton" type, and out-door architectural type Neon lights.

Still another important field for the electrician in the Neon industry is in maintenance service. No Neon sign will operate forever. Every tube will fail sooner or later. This is where maintenance comes in. It is for this reason that there are an ever-growing number of organizations specializing in Neon maintenance. In connection with maintenance, it may be mentioned that the usual practice in the industry is to guarantee every new sign for one year. Therefore, more and more electricians are finding employment in this field, where they are essentially trouble-shooters. They must know all possible reasons for sign failure, be able to fix or remove the faulty part and to replace it after repair. Besides, they should be able to drive a truck, handle a 30- or 40-foot extension ladder and have the ability to work high above the ground with equanimity.

Since many Neon signs are made with boxes of galvanized sheet iron, they must receive a paint finish. This work is generally done by the sign painter, who in the smaller shops also makes the layouts and even prepares salesmen's sketches. This work requires a skilled mechanic who can apply a finish that is artistic and that will endure.

Finally, the sign must be installed. The work of indoor-sign installation is that of the electrician, and has already been discussed. Outdoor installations are erected either as roof jobs which require steel structures, or they are directly attached to the building with lag bolts, through bolts, guy wires, tie rods, etc. Another form of display, favored chiefly by theaters, is the marquee, jutting out to the curb line about 15 feet above the sidewalk. This work is done by iron and sheet-metal workers specializing as sign hangers. Sign hangers also are often required to work high above the ground.

In concluding this section, it may be stated that the industry for its first few years was in a chaotic condition. Now, however, after about ten years of existence, it is standardized and Neon tubes and accessories are on a fairly stabilized basis. The Underwriters' Laboratories of the National Board of Fire Underwriters have arrived at product standards and the Underwriters themselves and local municipal electrical bureau have formulated and codified standard installation practice. Transformers, cable, insulators, and other parts are practically all of good construction and performance, and if the manufacturer adheres to accepted good form in processing and installation he produces Neon displays of average normal life and beauty.

Related Industries

In the Neon-sign industry there are no seasonal layoffs, but occasional lulls do occur after the beginning of the new year and in July and August. At such times, sheet-metal workers, draftsmen, and sign painters, and electricians employed in the industry can often find employment in the building and related trades, but opportunities for glass workers are more limited. Pump men, less skilled than glassblowers, may find employment possibilities with electrode manufacturers, manufacturers of radio, and other vacuum tubes and electric lamps. Many glassblowers are employed by large research organizations, chemical and physical, and other scientific apparatus manufacturers and with makers of specialty glass. It is obvious that glassblowers should be as widely trained as possible so that they may be able to take advantage of whatever opportunity arises.

Statistics

From the viewpoint of statistics in the Neon-sign industry, it is quite unfortunate that N.R.A. was declared unconstitutional. The National Electric Sign Association, conceived under N.R.A., was, among other things, to collect and correlate statistical information. Very little had been done when the demise of N.R.A. made the association powerless.

Census Bureau data for 1931 shows a total of 682 factories engaged in the manufacture of Neon and electric signs with $23,991,694 as the value of goods manufactured. It also shows that there are 55 factories in the State of New York. The 1936 classified telephone directories for the city of New York show more than 60 manufacturers listed. One of the supply houses catering only to Neon-sign manufacturers has more than a thousand accounts on its books, and does not claim to have half the business. The average estimate made by an owner who is an engineer and an authority, by a trade-publication representative, and by the writer, is 3,000 manufacturers employing about 30,000 workers.

Wages for glassblowers, sign painters, and sheet-metal workers are $1.25 to $1.50 an hour. Apprentices are paid 45 cents an hour and pump men 75 cents an hour. Electricians are paid $1.70 an hour and electricians' helpers $1.10 an hour.

Since this data is insufficient as a basis for a categorical conclusion, the best that can be done is to estimate. With more than 60 shops employing more than 600 mechanics, office and sales workers not included, in the city of New York, at least 40 boys per year can find opportunity for employment in the Neon-sign industry. More than twice this number can probably be taken up by the industry if the rest of the State of New York, New Jersey, Pennsylvania, Connecticut, and Massachusetts is considered. Moreover, and this reiterates a previous statement, increased employment opportunities will doubtlessly appear after the depression, when one considers the phenomenal growth of the industry up to now.

From this it would appear, in comparison with opportunities offered in other trades in which vocational training is given, that specific training of boys for Neon work is certainly worth while. For some workers in this industry, there are already courses available in the vocational and industrial high school, i.e., sheet-metal work and sign painting. Without much further training, men in these fields may adapt themselves to the work in the Neon-sign industry. However, men trained specifically for the industry are required when it comes to glassblowing, pumping, electrical and maintenance work, and for sales and office work.

The outline of the course of study which appears above will be found useful in the Neon-light shop. It is recommended that the course be of at least one year's duration, namely, the twelfth year. Teachers of related subjects should consult with the Neon instructor so that the proper in-

Outline of Course of Study

A. *Electric lamp displays*
1. Safety
2. Wiring and installation of sign receptacles
3. Wiring of lamps in one two-wire circuit
4. Wiring two circuits, three-wire
5. Wiring three circuits, four-wire
6. Layout of signs and border effects
7. Wiring of electric lamp signs

B. *Neon-tube displays*
1. Safety
2. Neon tubing
3. Electrodes
4. Insulators
5. Transformers
6. High-tension cable
7. Transformer installation
8. Low-tension wiring
9. High-tension wiring
10. Mounting Neon tubing
11. Wiring lamp and tube signs
12. Rotary converter installation

C. *Flashing of lamp and tube signs*
1. Safety
2. Time-switch installation and operation
3. Thermostatic-flasher installation and operation
4. Mercury-type-flasher installation and operation
5. Motor-flasher installation and operation
6. High-voltage (animator) flasher installation and operation

D. *Sign installation and maintenance*
1. Safety
2. Skeleton-sign installation
3. Window outline installation
4. Outdoor-sign installation
5. Trouble shooting
6. Replacing defective parts

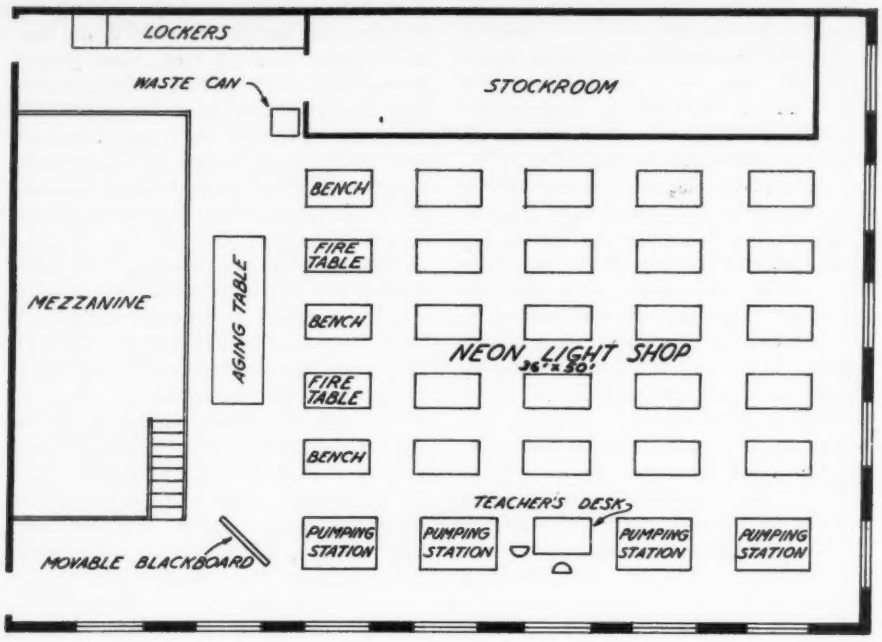
E. *Neon-sign design*
1. Choice of rare gas
2. Choice of glass tubing
3. Choice of gas pressures for various colors and tubing diameters
4. Use of transformer charts
5. The layout for porcelain-enamel and sheet-metal work
6. The layout for glassblowing
7. The layout for wiring
8. The layout for painting
9. Safety

F. *Bending of glass tubing*
1. Safety
2. Using the air blower
3. Using the gas booster
4. Using cross-fires
5. Using the hand torch
6. Using ribbon burners
7. Oxygen regulators and their use
8. Using the splicing torch
9. Using cannon fires
10. Straight splices
11. T and Y splices
12. Sealing on tubulations
13. Sealing on electrodes
14. Angle bends
15. Back bends
16. Combination bends
17. Smooth curves
18. Working with Pyrex and special glass

G. *Evacuation of Neon tubing*
1. Safety
2. Use of stop cocks
3. Use of vacuum gauges
4. Use of mechanical pumps
5. Use of aspirators
6. Operation of the manifold
7. Attaching units to the manifold
8. Evacuation
9. Finding and repairing leaks — use of the spark coil

H. *Bombarding of Neon tubing*
1. Safety
2. Use of the bombarding transformer
3. Operating transformer controls and switches
4. Connections for bombarding
5. Simple bombarding for Neon tubing
6. Simple bombarding for Argon-Mercury tubing
7. Simple bombarding for helium tubing
8. Special cases for bombarding

J. *Filling and aging of Neon tubing*
1. Safety
2. Use of the rare-gas supply
3. Attaching gas containers
4. Tipping off
5. Filling Neon tubing
6. Filling Argon-Mercury tubing
7. Filling helium tubing
8. Aging and testing tubing



Neon-light shop

struction can be given in drawing (preparation of sketches and layouts), trade mathematics (computing estimates, tube lengths, and current consumption and cost), and science (transformer theory, theory of gaseous conduction, theory of atmospheric pressure and related phenomena, theory of vacuum-pump operation and the characteristics and properties of materials used in the industry, viz., the rare gases, electrode metals, glass, etc.).

Equipment and Supplies

The shop shown diagrammatically in the illustration, was designed for a class of twenty boys. In actual practice, the glassblower works between the fire table and the bench, and this arrangement has been adhered to. For economy's sake, two boys will work at opposite sides of each fire table, each side being equipped with splicing torch, cross fires, ribbon burner, and cannon fire. A gas booster is used to augment the city gas pressure, feeding all burners at the fire tables and pumping stations. The booster is located under the mezzanine. There is one blower or air compressor below each fire table since it is more economical to operate in this manner than to have one large compressor for all fires. Fire tables, benches, pumping stations, and aging table should be of sturdy angle-iron, with transite tops.

Each of the four pumping stations has a Cenco Megavac pump, two with mercury aspirators and two with butylphthlate aspirators. Each is equipped with a 5 KVA bombarding transformer and regulator, tipping-off torch, Dubrevin gauge and spark-coil tester. There also is one McLeod gauge. Each manifold has two positions for pumping and has one liter each of Neon, Argon, and helium attached. One air compressor, located under the mezzanine, supplies air pressure to all four stations.

The mezzanine is constructed with eight 4-in. by 4-in. angle-iron uprights reaching from floor to ceiling. These, as well as the auxiliary uprights, have belted to them, back to back, two 2-in. by 2-in. angle irons. For their entire length, the latter have ⅜-in. holes punched in them, 3 in. center to center. This furnishes the means for erecting signs for various operations and demonstrations. The wooden floor of the mezzanine is 6 ft. 10 in. off the floor of the shop and has a 2-in. pipe railing. Switches and feeders are attached to the uprights just below the mezzanine floor. Marine-type safety lamps are used for illumination below this floor. There are several emergency switches controlling all electrical equipment located around the shop walls for the teacher's use only.

The other items are more or less self-explanatory. These include lockers, stockroom (with bins for glass tubing), waste can, movable blackboard, and the teacher's desk and chairs. There is ample room for a filing cabinet, and a combination sink and drinking fountain is located under the mezzanine. The aging table may also be used for demonstrations. Below each window is a radiator, some being of the two-unit ventilator type.

Alternating-current outlets are available as follows: At each pumping station, a 220-volt connection for the bombarding transformer, a 110-volt connection for the spark-coil tester, and a 110-volt connection for the pump motor; at the fire tables, a 220-volt connection for each compressor motor; at the aging table, several 110-volt outlets; under the mezzanine, a 220-volt connection for the gas booster and a 220-volt connection for the compressor motor for the pumping stations. The feed lines under the mezzanine have two- or three-wire 110-volt lines for connecting signs and flashers. Direct current also is available for demonstrating rotary converters and starters.

The following is a list of supplies needed for the Neon-light shop. Quantities have been omitted. Glass tubing, transformers, and similar merchandise is carried in stock by most sign-supply firms, and other supplies are generally stocked by several concerns catering to the Neon-tube and vacuum-tube industries.

Glass tubing, Corning, type G 1, diameters from 5 mm. to 25 mm., clear and colored
Pyrex tubing, ditto
Electrodes of all types (G 1 and Pyrex)
Rare gases in one-liter containers: Neon, Argon and helium
Mercury, C. P.; Corks; Chalk; Glass-cutting files; Tanks of oxygen; Tanks of carbon dioxide; Rubber battery clips; Mica pieces; Map scale
Rolls Kraft paper 36 in. wide
Rolls sheet asbestos 36 in. wide
Rolls brown gummed paper 3 in. wide
8 mm. soft glass stop cocks
3 mm. ditto; 2 mm. ditto; Stop-cock grease
Oil for vacuum pumps — lubricating
Assorted rubber tubing; High-tension cable
Core and coil-type transformers, 2500 to 7500 volts
Enclosed-type transformers, 5000 to 15000 volts, up to 60 ma.
Hanging-type transformers, ditto
Housings and bushings, assorted types
Elevation posts; Cleats; Federal bushings
Assorted sign receptacles
Machine screws and nuts, assorted
Wood screws, assorted
10-watt lamps, white and colored
Electric meters as follows: Milliameters, voltmeters and ammeters of various ranges, a wattmeter, a watt-hour meter and a Voltrol
Thermostatic flashers; Mercury-type flashers; Motor flashers; Animators; Time switches
¾ and 1½ h.p. rotary converters
Starters for above; Copper tie wire
2 and 3 wire BX and BXL No. 14; No. 14 XBRC wire; Condulets, 3-in. boxes, etc.; Assorted electricians' tools; Rubber and friction tape; Solder, flux, soldering irons; Mortized grindstone; Regulators for O_2 and CO_2; Oxygen hand torches; Mixers for various torches; Copper braid wire
Neon block-out paint
Assorted paint brushes
Sherman connectors
Fahnestock connectors
Stove bolts and nuts, assorted
½-in. conduit and fittings
Hickey

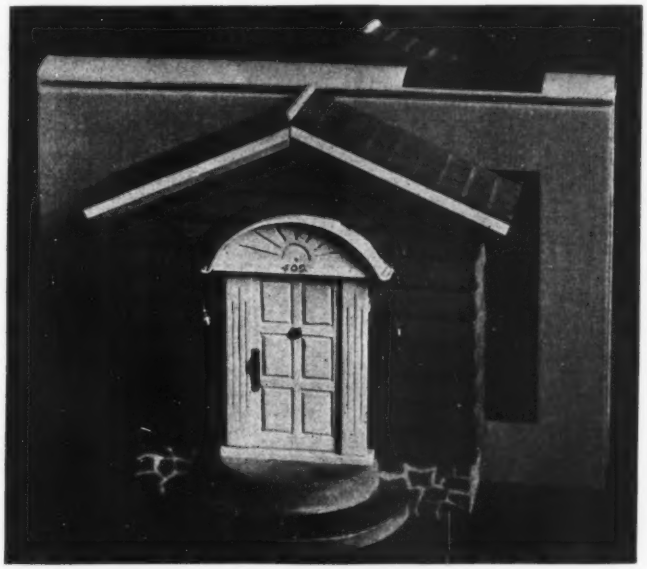
Problems and Projects

BOOK ENDS

V. L. Pickens, Supervisor Industrial Arts, and L. L. Bowen, Instructor Industrial Arts, Kansas City, Missouri

The accompanying illustration shows the possibilities of the miniature entrance used as a decorative unit.

The part apparently covered with shingles is made of one piece of white pine. The horizontal cuts were made with a hack saw. The waste was chiseled out across the grain to get the proper texture. The vertical lines were made with a knife. The door panels were carved with a knife and the vertical lines on the casing were marked with a gauge. A paper clip forms the knocker, bent brass-escutcheon nails are the hinges, and 22-gauge shells soldered to nails are used for side lights.



Architectural book ends

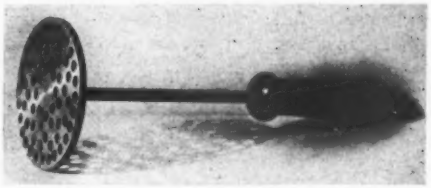
The possibilities are unlimited, both for finding good architectural designs, and for developing ingenuity in making the parts.

POTATO MASHER

Laurence Pitcher, Union High School, San Juan Capistrano, California

For those interested in a simple project for the general shop, the potato masher described and illustrated in this article will serve very nicely to add to the list of suitable projects, which the boys make.

This project gives the student a large variety of operations to perform and also experience in working several different kinds of material in the same project.



Potato masher

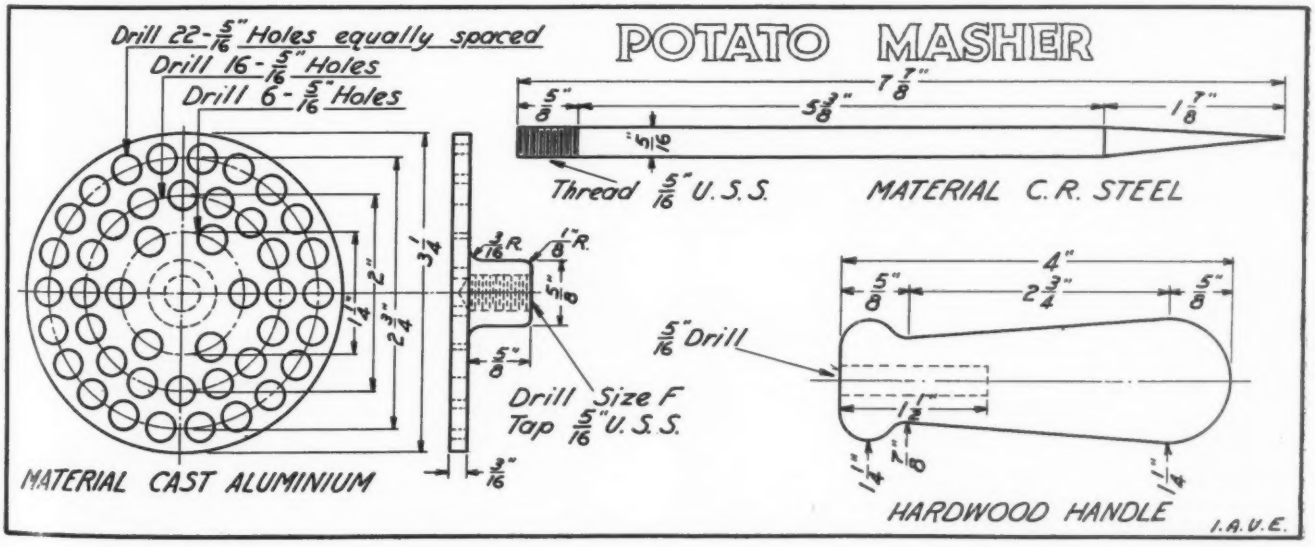
The cost of the potato masher is very little, which makes it well adapted to those situations where the expense of a project is an important item in the boy's mind.

When completed the project serves as a nice gift for mother and will be found to be very useful in the kitchen.

HOUSE WIRING

Charles A. Bacheller, Essex County Boys' Vocational School, Newark, New Jersey

The electrician who wishes to become a success at this particular branch of the trade, must acquire certain knowledge which may be considered to be entirely foreign to the electrical trade. First of all, he must have a good idea of building construction. This helps him in solving many problems which may arise and will be of great value to him and his employer in planning procedures. Building codes must be considered, as this has a definite bearing on the construction of different types of houses. Problems that arise on one job may not be encountered on another, but the wireman must always keep in mind the primary objective, that is, a finished wiring job at a minimum of time and expense. The necessity of neatness in finished-building wiring need hardly be mentioned. Usually the buildings that are to be wired are occupied and furnished and the tactful wireman will



subject the occupants to a minimum of inconvenience and will make as little debris as possible.

There are many items or steps into which the wiring of a finished building may be analyzed, but in this article only the main items are considered. Assume, for instance, that the estimator or contractor has given the electrician a tentative plan or layout of the job with the number and location of the outlets and that the material has already been placed on the job. The following steps are in logical sequence:

1. Check and store the material.
2. Inspect the building to ascertain type of construction.
3. Locate suitable place for meter board.
4. Locate space in which to run risers.
5. Plan circuits.
6. Locate and mark positions of all outlets.
7. Cut outlets for lights, switches, convenience outlets, and panel boxes.
8. Take up flooring, cut pockets, and remove baseboard and trim where necessary.
9. Put in cleats for supporting lights and switch boxes.
10. Bore all necessary holes through which to run cable.
11. Run risers from meter location to position of panel box.
12. Run all circuits and fish-in cable where necessary.
13. Connect armored cable to boxes and fasten all boxes in place.
14. Replace flooring, baseboard, and trim (rough inspection must be made before floor is fastened in place).
15. Connect, solder, and tape all wires where necessary. (If the wireman is careful to watch the color of wires, a circuit test will not be necessary.)
16. Mount and connect all switches, convenience outlets, and cutouts.
17. Build and paint meter board.
18. Mount meter device.
19. Bore or drill hole through foundation for service conduit.
20. Pull in service wires and connect to meter device.
21. Install ground conduit, and run in and connect ground wire and jumpers.
22. Connect risers to meter device.
23. Make a general check and clean up the job.

The installation of fixtures is not considered in this layout and in many cases is a separate contract.

Each of the main steps just enumerated may be considered a job with many minor steps and operations. For example, take step No. 8 — taking up flooring. There are several types of flooring and many ways in which they might be layed. Each type offers a different problem. The simplest type of flooring to be raised involves ten or more minor steps, and these, again, may be separated into many operations.

It would be almost impossible for the student to acquire all of this information in the short time available in the vocational school. It is better, therefore, to get him to understand and train him so he is able to apply the most important elements of this phase of electrical work. The rest will come when he obtains actual experience in practice. Therefore, the instructor should wisely plan the course so that it covers the essentials of the trade. The amount of additional material, then, that can be covered, will depend on the length of the course and on the pupil's ability to acquire knowledge.

A HUNTING KNIFE

Gerald A. Boate, Seattle, Washington

During the past five years, over 200 sheath knives were made in our school shop. While scrap was the only material utilized, yet the finished product was high grade in every way.

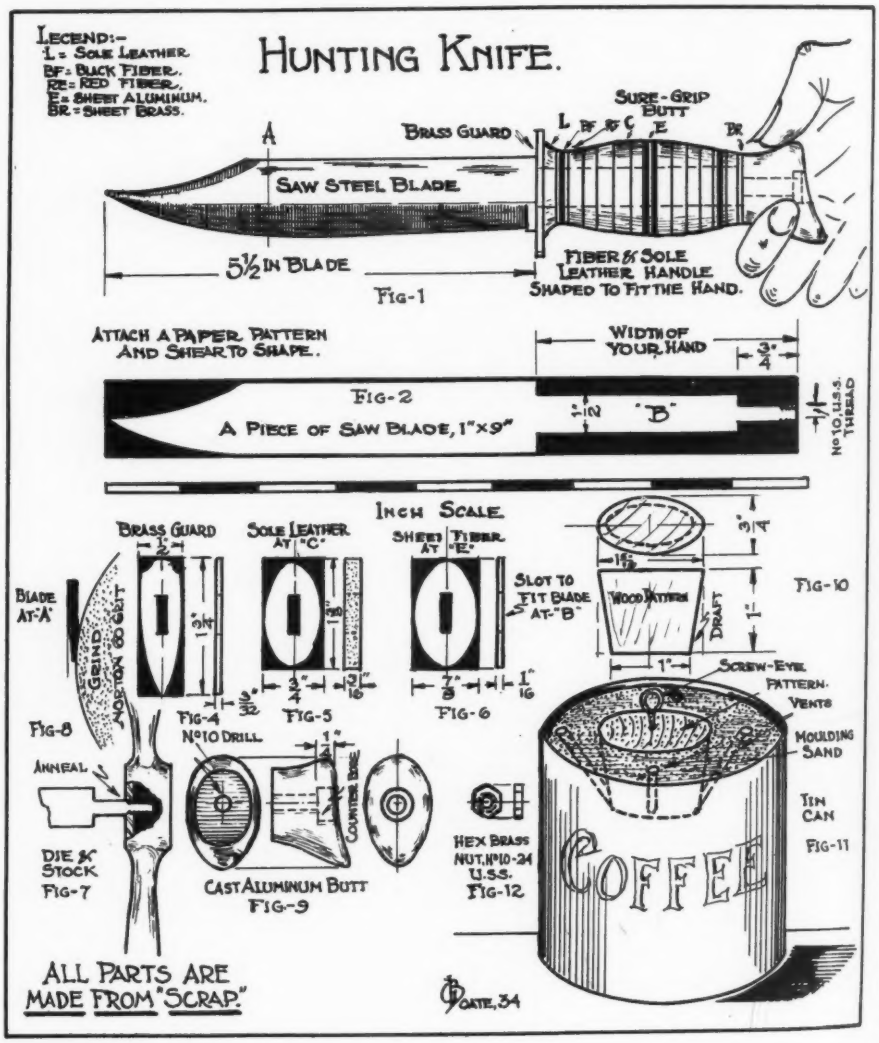
Method of Procedure

1. Make a paper pattern as shown in Figure 2.

2. Transfer this pattern to the blade. For best results, use a saw blade that is about .064 in. thick. Anneal shank D of the knife blade so that it may be cut to the shape shown in Figure 2. To protect the cutting part of the blade during the annealing processes, wrap it in wet rags and keep them wet. Then heat the shank to a dull red heat, after which bury the whole blade in fine dry sand or dry slaked lime and allow it to cool. If the shank is still too hard to work, repeat the annealing process as many times as is necessary to soften the metal properly. Cut the shank to the shape shown at B in Figure 2 and finish the portion which is to be threaded with a file.

3. Cut the thread by placing the blade between the vise jaws with about ¾ in. of the shank projecting. Cut the thread slowly and carefully, using plenty of cutting oil. Do not force the die as this small portion of the shank is easily twisted off. Fit a No. 10/24 brass hexagon nut to the threaded part. A brass nut is used so that the solder, in which it is later to be imbedded, will stick to it.

4. Grind the knife to the shape shown in Figure 2. Keep the blade cool by frequently dipping it into water. Dress the grinding wheel and adjust the tool rest below center. To obtain a uniform concave cutting edge as shown in Figure 8, one must acquire a certain stance. Grasp the knife as shown in Figure 13 with the two hands interlocking. Stand at the side of the grinding wheel, with heels together, elbows on hips, body rigid, and so that you can rock back and forth from the ankles. Then place the blade against the wheel and, swaying back and forth, always keeping the knife at the angle shown in Figure 8, keep up the grinding operation until



the cutting edge is ground smoothly concave and as far back toward the handle end as shown in Figure 1. The amount of the concave depends upon the diameter of the grinding wheel. The one shown in Figure 13 is 4 in. in diameter dressed convex.

5. Make a brass guard as shown in Figure 4. Cut disks of sole leather as shown in Figure 5, also red and black fiber disks as shown in Figure 6. Make the holes in guard and disks so that they fit snugly over the shank.

6. Make a wood pattern for the butt as shown at Figure 10.

7. Imbed this in molding sand as shown in Figure 11.

8. Melt scrap aluminum and cast the butt.

9. Drill and counterbore the aluminum butt as shown in Figure 9.

10. Shape the aluminum butt roughly.

11. Assemble the handle as shown in Figure 1. To do this, wrap the blade in several thicknesses of wrapping paper and clamp it, shank upward, in the vise. Work the guard carefully downward until it rests on the shoulders. Then thoroughly clean both guard and shank, where they meet, with emery cloth. Work soldering paste into the crack and melt solder around the joint. A good soldering job will make blade and guard look as though made of one piece.

12. Next, work the leather and fiber disks in place as shown in Figure 1. The legend indicates the meaning of the letters used in Figure 1. Pack each disk down firmly. The last disk put on before the aluminum butt is put in place should be of sheet brass so that any opening between aluminum and brass may be filled with solder. Finally draw up the brass hexagon nut firmly, apply soldering paste to the nut and fill the counterbored hole with solder.

13. Use a wood rasp to work the handle to a shape that will fit the hand. Then with a strip of sandpaper, proceed to smooth the handle as shown in Figure 14. Begin with No. 1 sandpaper and continue using a finer grain as the final finish is approached.

14. Try the temper of the blade. If the cutting edge has softened during the annealing process, heat an iron plate to a dull red and rest the back of the blade on it, keeping the cutting edge slightly raised. This permits the heat to travel slowly from the heavier part of the blade to the cutting edge. When the latter has turned to a deep straw color, plunge the blade quickly into clean cold water, thrusting it in and out rapidly so that the chilling will be evenly distributed near the shank. This surging is important and makes the knife tough rather than brittle.

15. Next, polish the blade by rubbing it over fine carborundum powder which has been spread over a smooth piece of softwood. Rub the blade straight forward and back, avoiding all sidewise motion (See Figure 15).

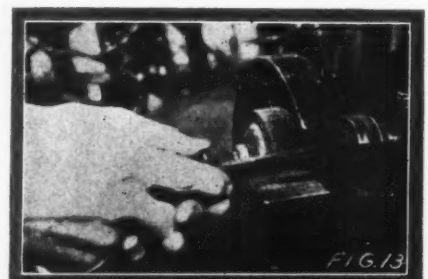


Fig. 13. Grinding the cutting edge. Fig. 14. Whip-sanding the handle using a doubled-over abrasive cloth. Fig. 15. Using a wood block, emery powder, and oil to bring the knife blade to a high polish

BRACELET WITH CHASED DESIGN

William J. Becker, Boynton Junior High School, Ithaca, New York

The type of ornamentation used on the bracelet described herewith, although more difficult than etching, is considered by many to be better looking, if done properly.

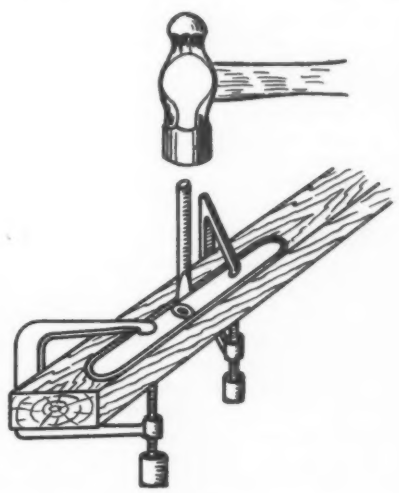


Fig. 3

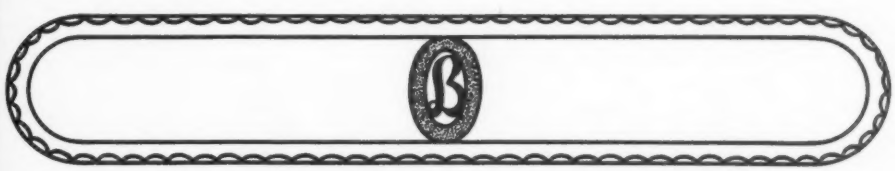


Fig. 1

Fig. 2

Materials required:

1 piece of No. 18 gauge copper, brass, or German silver, the size of the design.

Directions:

1. Decide upon type of design to be used (See Figs. 1 and 2).
2. Using squared paper, make design. Observe the following rules:
   a) Get length of bracelet by winding a narrow strip of paper around wrist. The ends should lack ½ in. from meeting.
   b) The design must be of a type that will lend itself to chasing. Show design to the instructor before it is too far advanced.
   c) Design must *not* be too complicated.
   d) It is preferable to have a design of your own. If help is needed, however, refer to the display board, or to a folder of designs.
3. After the instructor has checked the design, cut out the metal.
4. If the ends of the bracelet are to be rounded, set the dividers for half the width of the bracelet and scribe a circle at each end.
5. Cut the bracelet to shape and file ends smooth.
6. Transfer design to metal.
7. If another type of ornamentation is to be used on the bracelet, besides chasing (such as peening, etc.) do this next.
8. Chase all straight lines first; clamp piece of narrow but heavy gauge metal to the line to be chased (Fig. 3). Clamp both to the stake. Check this operation with instructor; also, first practice on scrap metal.
9. If design contains letters or an irregular design, chase these portions.
10. Bend bracelet to fit wrist. Make slight bend first, then end with sharper curved ends.

11. If bracelet is to be polished, do this on the buffer.
12. If it is to be colored, immerse in a liver-of-sulphur solution until desired color is reached. Rinse in water and blot dry, or dry in sawdust barrel.
13. Polish lightly with clean cloth and give a coat of laquer to preserve color.

References:

1. Shop design file.
2. Shop display board.
3. *School and Home Shopwork* by Schultz, Allyn & Bacon, Boston, Mass.
4. *Metal Work* by Jones, Bruce Publishing Co., Milwaukee, Wis.
5. *Cold Metal Working* by Van Leuven, McGraw-Hill, N. Y.

Questions:

1. Imagine yourself making a bracelet 1¼ in. wide. To what distance should dividers be set to get a half circle at each end of the bracelet?
2. Why are copper cooking utensils frequently coated with tin? Ref. 1, page 192.
3. Tell what corrosion is, in regard to copper. Ref. 4, page 50.
4. "Drawing and design is older than written language." Tell what is meant by this statement. Ref. 3, page 6.
5. Give the melting points of copper, tin, aluminum, lead. Which is the highest? lowest? Ref. 5, page 266.

BOOK ENDS OF COPPER OR PEWTER

E. W. Manzer, Bronxville, New York

The squirrel book end provides a number of metalcraft processes that give the student a variety of experiences. To add interest to the book ends when they are in use, try to place books with colored covers next to the pierced areas.

In getting out the stock for the project, cut two pieces 5 by 8¾ in. for the uprights and bases if copper is used. If 12- or 14-gauge pewter is used, cut two pieces 3 by 5 in. and two pieces 5 by 5¾ in. The 18-gauge copper may have the base bent to shape, while the pewter base may be soldered to the upright using the right-angle method of soldering shown on page 368 of the December, 1935, issue of this magazine.

Before transferring the design to the metal, clean the surface of the metal with old, fine grit emery cloth to remove the oily surface of the metal. Then cover the metal with a thin coat of white water paint or show-card white. Dry the paint by warming the metal slightly, and then transfer the design with carbon paper.

To saw out the areas, holes must be drilled in each area so that the jeweler's saw (Number 4 or 6) may be inserted for cutting out the white spaces. If copper is used, the saw blade must have finer teeth (Number 2 or 3). Rub the saw blade with a cake of paraffin or wax, or place a piece of oiled cardboard under the copper sheet. This makes the sawing easier and lengthens the life of the saw. After the design has been cut out, file all edges properly and finish them with old emery cloth and fine steel wool.

To further enrich the project, the squirrel and the acorns may be dapped from the back. This is done by placing the metal on a sheet of lead or on a pitch block, and then hammering the metal from the back with a ball peen hammer or special dapping tools.

If copper has been used a very rich finish may be obtained by scratch brushing the surface of the metal or thoroughly cleaning the metal with fine steel wool and fine pumice stone. After the surface has been cleaned do not let the hands touch the surface. Handle the metal with cloth gloves if possible.

Pewter book end

Prepare a solution of liver of sulphur and water, sufficient to cover the book ends, and place it in a container large enough to take the work. Heat the solution and submerge the copper book end until it is covered with a film of black oxide. Remove the work, dry, and then scratch brush again or rub with fine steel wool which will bring out the high lights. Lacquer with clear metal lacquer or rub with a thin coat of furniture wax. If desired the surface of the metal may be planished to enrich the surface. This, however, must be done before the metal has been treated with the oxidizing solution.

The pewter metal may be highly polished on a buffer or it may be given a satin finish with steel wool dipped in water and then in pumice stone. Rub the surface briskly and wash in clean water. This metal may also be lacquered to preserve the finish. To oxidize the pewter, mix a strong solution of nitric and sulphuric acid adding a little water. Wash off the oxide formed and rub lightly with fine steel wool.

Full-size design for pewter book end

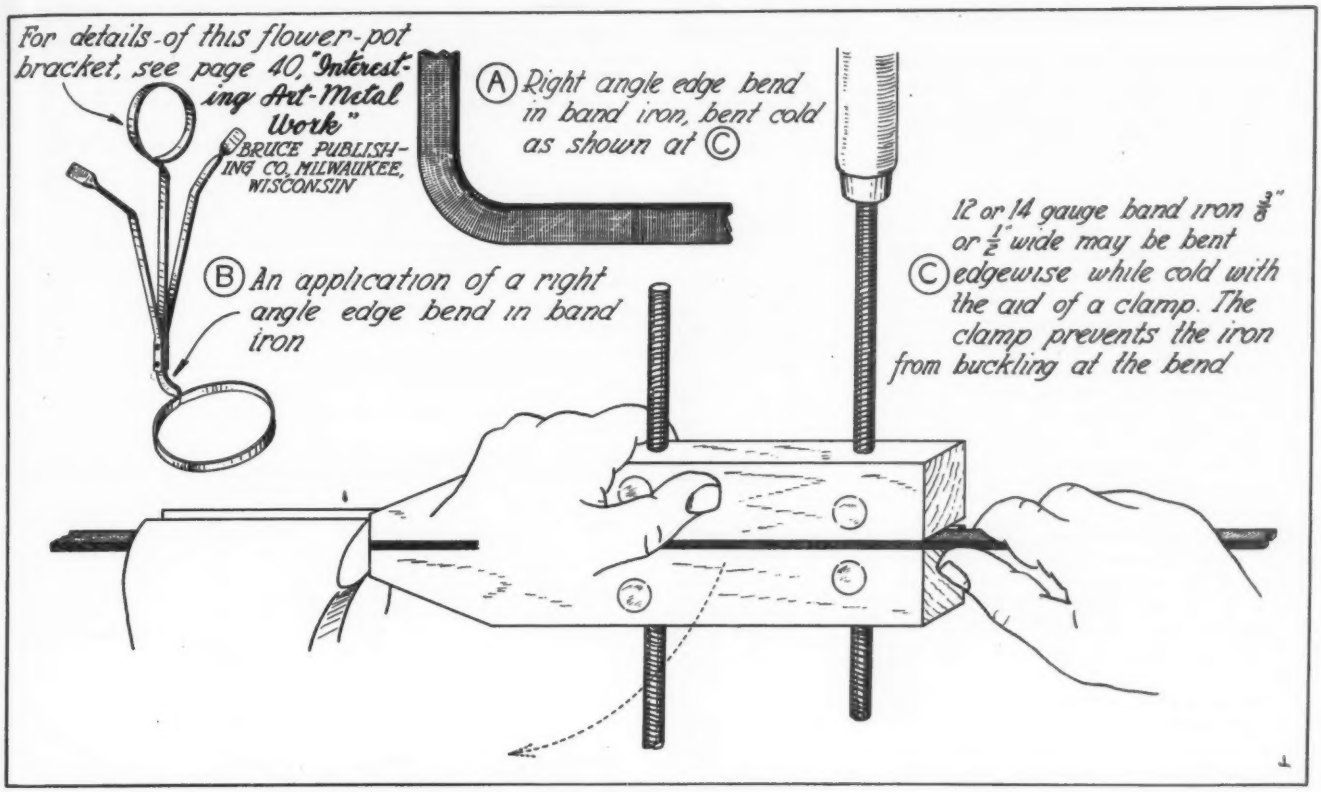

For details of this flower-pot bracket, see page 40, "Interesting Art-Metal Work" BRUCE PUBLISHING CO. MILWAUKEE, WISCONSIN
A Right angle edge bend in band iron, bent cold as shown at C
B An application of a right angle edge bend in band iron
12 or 14 gauge band iron 3/8" or 1/2" wide may be bent C edgewise while cold with the aid of a clamp. The clamp prevents the iron from buckling at the bend

Fig. 1. Method of making cold bend

MAKING EDGE BENDS IN BAND IRON

Joseph J. Lukowitz, Milwaukee, Wisconsin

Edge bends in the much used 12- and 14-gauge band iron, ⅜ in. or ½ in. wide can easily be made in cold iron as shown in Figure 1. This method of making edge bends eliminates the time required for heating and also eliminates the congestion of pupils at the fire with its accompanying hazards.

To make right-angle edge bends in cold iron in this way, place the iron in a vise as shown at C in Figure 1. The bend, of course, will be made outside of the vise jaws, so locate the iron accordingly. With the iron in the vise adjust a clamp so that it will fit over the band iron as shown, and then pull the iron around as indicated by the dotted arrow. The clamp jaws will prevent the iron from buckling during the bending process. As the iron is being bent it may be necessary to shift the clamp once or twice to keep the jaws over the part of the iron where the bend is being formed. Unless this precaution is taken, buckling will occur wherever the bend is not covered by the clamp jaws.

CANDELABRA

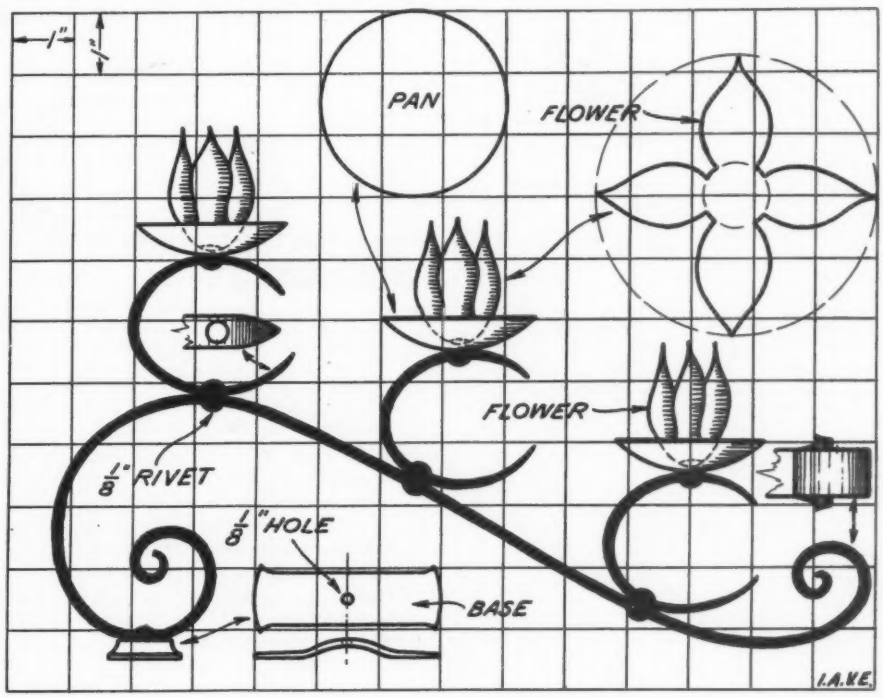
Colin D. Robertson, Jamaica Vocational High School, Jamaica, New York

1. Make a full-size drawing.
2. Take the measurements of the stock from this drawing.
3. Use ⅛ by ¾-in. band iron for the long scroll piece, ⅛ by ¾ in. for the base, and ⅛ by ½-in. for the scrolls beneath the pans.
4. Use scrap sheet iron for the pan and the bud.
5. Raise the pan with a ball-peen hammer.
6. Form the bud on a piece of ½-in. pipe.
7. Shape the long scroll on the anvil.
8. Make a "jump-over" on the base to permit the rivet to clear.
9. Drill holes for rivets.
10. Assemble the parts.
11. Finish natural or use flat black paint.

LEGEND OF THE CLOCK DIAL

Melvin F. Hall, Buffalo, New York

From the Standard Electric Time Company of Springfield, Mass., manufacturers of electric program clocks and signal systems for schools, hospitals, and other public buildings, comes this interesting story about the Roman



numeral IIII as it appears on many clock dials.

The legend handed down by watchmakers from one generation to the next is that the first clock which in any way resembled those now in use was made by Henry Vick in 1370. He made it for Charles V of France who has been called "The Wise."

History shows that Charles was wise in a good many ways. He was wise enough to recover from England most of the land which Edward III had conquered, and he did a good many other things which benefited France. But his early education had been somewhat neglected. Still, he had a reputation for wisdom, and thought that it was necessary, in order to maintain it, that he should appear to possess book learning. The latter was a subject on which he was extremely sensitive.

Thus when Vick, the watchmaker, presented the new clock to King Charles the following conversation ensued:

"Yes, the clock works well," said Charles, "but," being anxious to find some fault with a thing he did not understand, "you have the figures on the dial wrong."

"Wherein, Your Majesty?" said Vick.

"That four should be four ones," said the king.

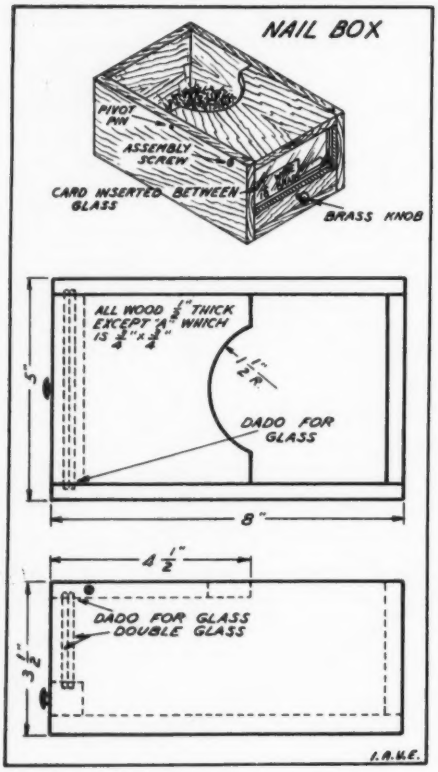
"You are wrong, Your Majesty," said Vick.

"I am never wrong!" thundered the king. "Take it away and correct the mistake!" And corrected it was, and from that day to this, 4 o'clock on many watch and clock dials has been IIII instead of IV.

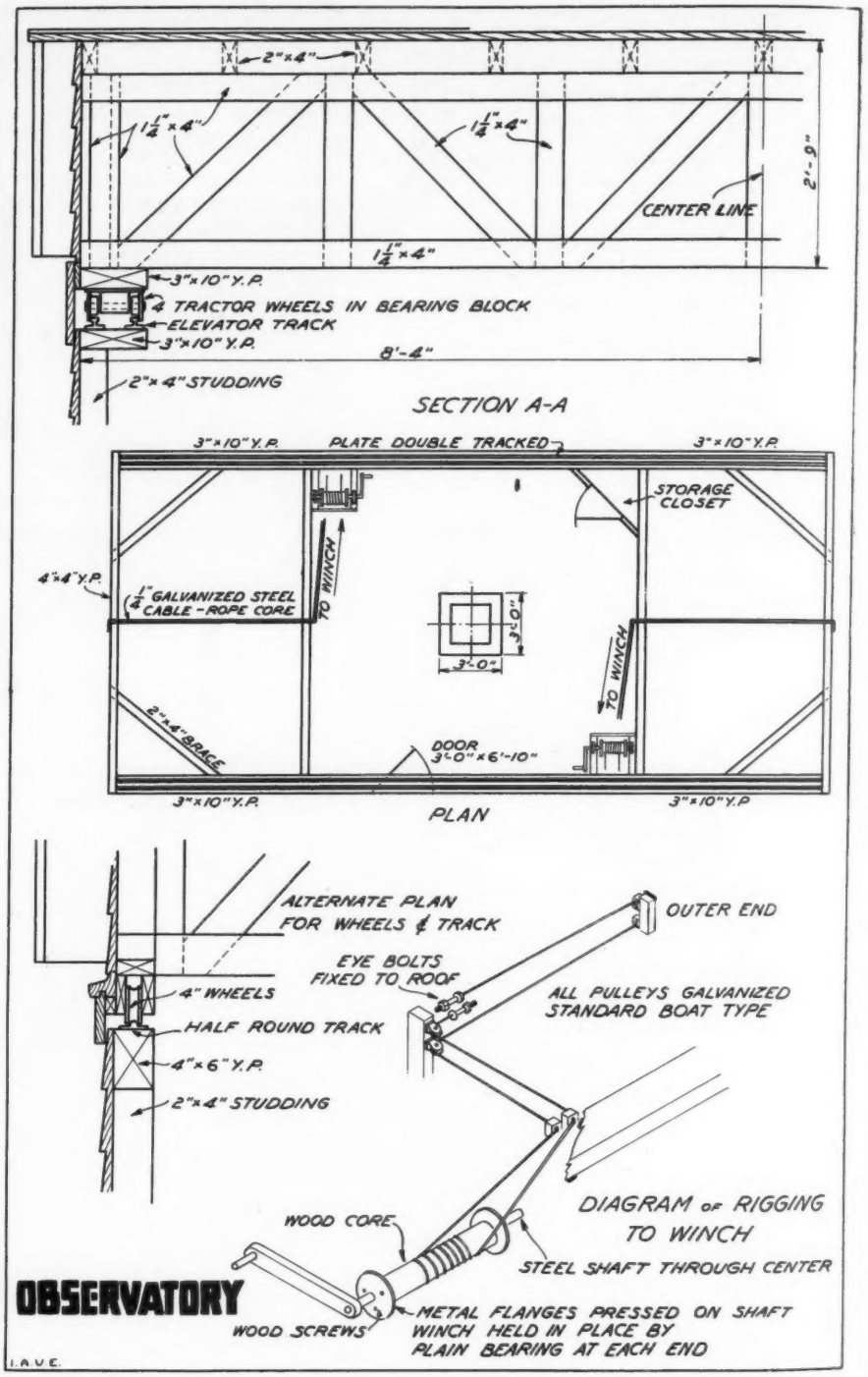
NAIL AND SCREW BOX

George W. Bowen, Salem, New Jersey

The box described and illustrated herewith, serves to hold nails, brads, screws, and the like, in such a manner that the size, kind, and amount contained in the box may be discerned at a glance. When in use, the box is removed from the rack or cabinet, and taken to the bench or other place of work. The pivoting lid serves to hold in place the double glass in the front and allows the inside of the box to be cleaned easily, or the card between the two pieces of glass to be changed readily.



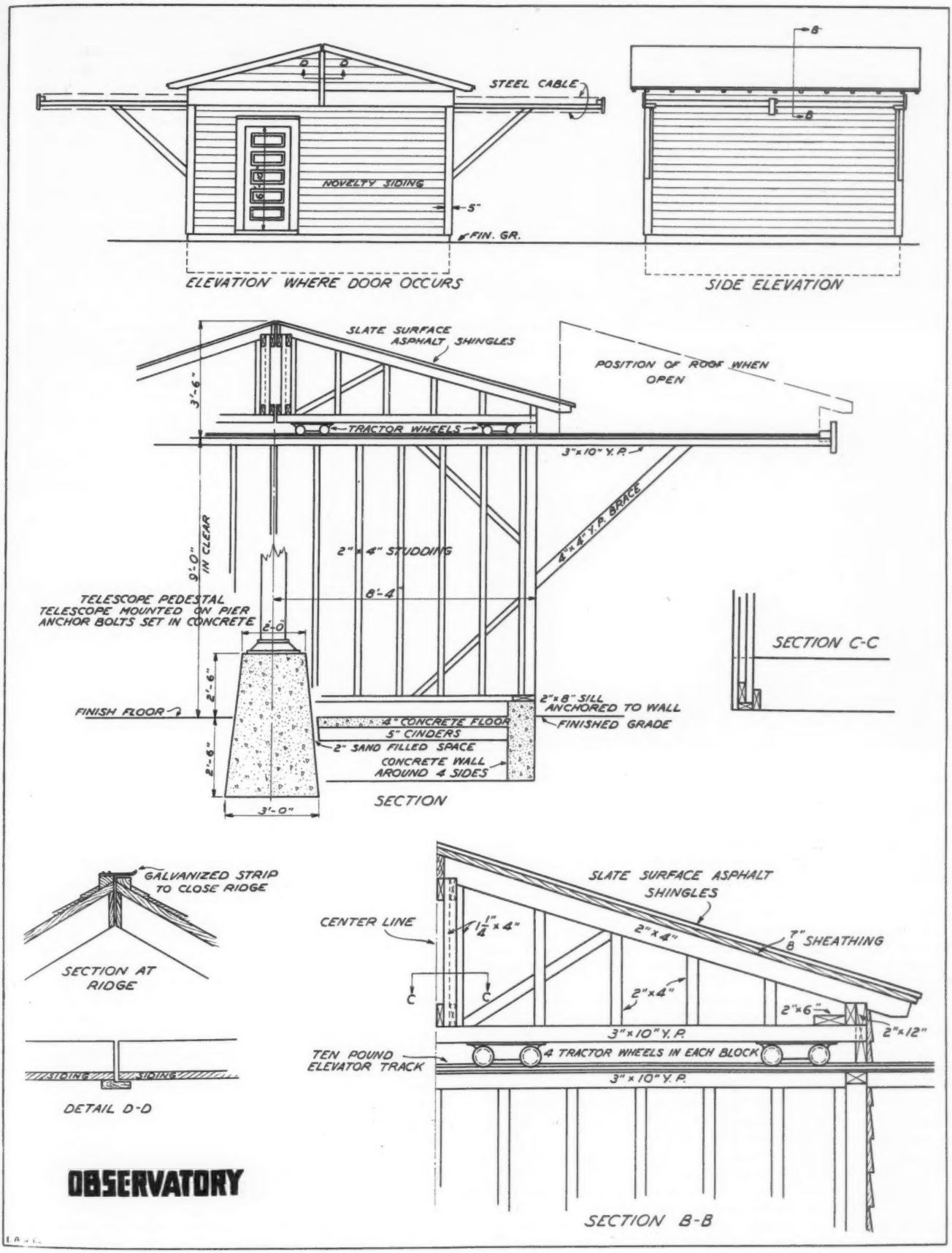
It may be well to construct separate wall cabinets for wire nails, wire brads, tacks, and for the various types of screws such as flat-head, oval-head, and round-head.

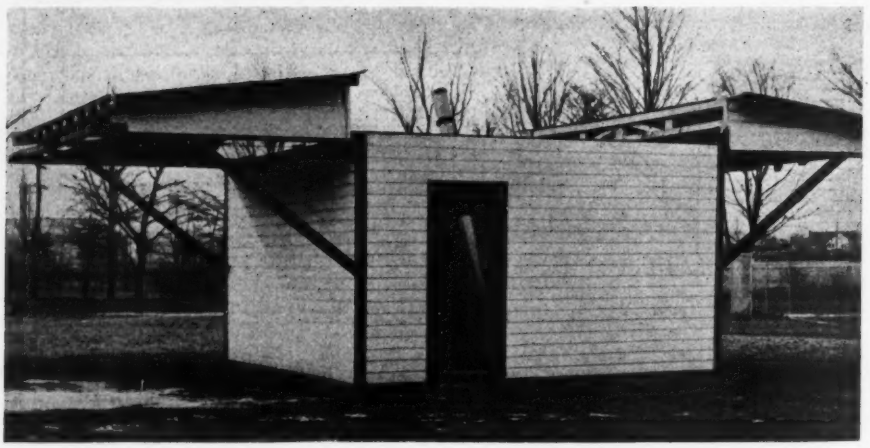


OBSERVATORY FOR SCHOOL OR HOME

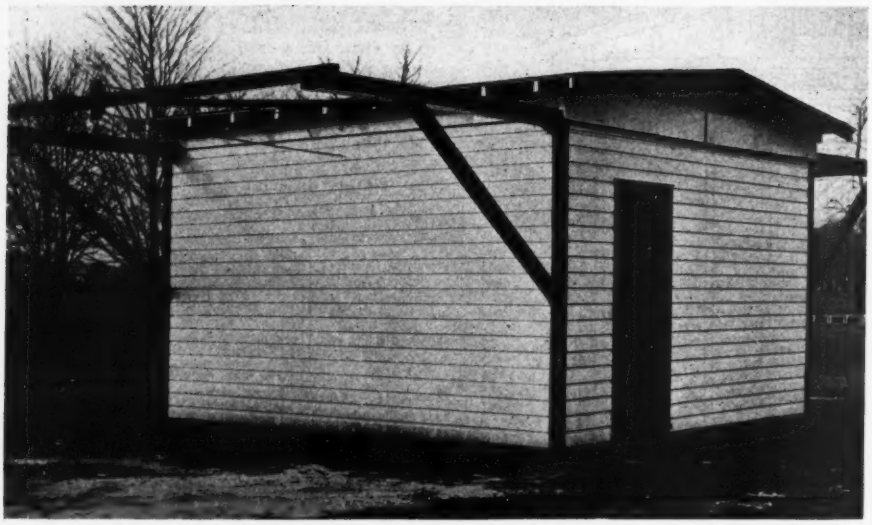
John N. Willmott, Industrial Arts Supervisor, Garden City Public Schools, Garden City, New York

In the November, 1935, number of the *Journal of the National Education Association* there is a picture of a school observatory. The usual type of circular observatory, made of concrete, brick, and steel, and capped with a movable metal dome, is an expensive engineering undertaking. This is


STEEL CABLE
NOVELTY SIDING
5"
FIN. GR.
ELEVATION WHERE DOOR OCCURS
SIDE ELEVATION
SLATE SURFACE ASPHALT SHINGLES
POSITION OF ROOF WHEN OPEN
TRACTOR WHEELS
3"x10" Y. P.
4"x4" Y. P. BRACE
2"x4" STUDDING
9'-0" IN CLEAR
3'-6"
8'-4"
TELESCOPE PEDESTAL
TELESCOPE MOUNTED ON PIER
ANCHOR BOLTS SET IN CONCRETE
2'-0
2'-6"
FINISH FLOOR
2'-6"
3'-0"
2"x8" SILL ANCHORED TO WALL
FINISHED GRADE
4" CONCRETE FLOOR
5" CINDERS
2" SAND FILLED SPACE
CONCRETE WALL AROUND 4 SIDES
SECTION
SECTION C-C
GALVANIZED STRIP TO CLOSE RIDGE
SECTION AT RIDGE
SIDING
SIDING
DETAIL D-D
OBSERVATORY
SLATE SURFACE ASPHALT SHINGLES
CENTER LINE
1 1/4" x 4"
2"x4"
7/8" SHEATHING
C
C
2"x4"
2"x6"
2"x12"
3"x10" Y. P.
TEN POUND ELEVATOR TRACK
4 TRACTOR WHEELS IN EACH BLOCK
3"x10" Y. P.
SECTION B-B



Observatory with roof open



Observatory with roof closed

largely the reason why more schools do not have them.

In 1934, the Garden City High School was offered the use of an excellent 8-in. refracting telescope provided that it could be properly housed. The industrial-arts department thereupon built the one described in this article. It is comparatively inexpensive and may therefore be of interest to industrial-arts teachers in schools where students are studying astronomy.

Since funds were limited, a wooden building was decided upon. Plans were worked out in detail very much as they are submitted here. It was decided that a roof with very little pitch, opening in the middle and sliding on projecting tracks should be tried. Several visits to junk yards yielded the necessary materials. The tracks had formerly been used as guide rails in an elevator shaft in a nearby sand and gravel pit. The wheels were taken from a tractor which had been junked. The pulleys were purchased from a firm dealing in ship's stores, and are the ordinary galvanized type used on sailboats. The winches consist of a 3-in.-diameter wooden drum with a 1-in. steel shaft through the center. Flanges, 4 in. in diameter and ¼ in. thick were pressed on each end of the shaft against the wooden drum and wood screws were fastened through the flanges into the wood drum to prevent it from turning on the steel shaft when the cable was wound upon it. The cable winds readily on the drum and the wooden face furnishes an excellent gripping surface for it. A ¼-in. rope-center galvanized-steel cable was used with about six turns on the drum. The problem of leakage at the center of the roof was met by placing an overlapping metal strip as shown in the plans. The concrete block for mounting the telescope is separated from the rest of the building by a 2-in. space partly filled with sand. This prevents jar and vibration of the telescope, an important factor when actual observations are under way.

Since the observatory has been in operation for nearly two years now, the results of its experimental features may be pointed out. These, as a whole, have been very satisfactory. Freedom from leakage has been a feature of the observatory, the overlapping strips where the edges of the roof come together proving quite adequate. It is so simply arranged that only one person is required to operate the opening and closing of the roof from the inside. Closing the roof, by the way, is accomplished simply by reversing the direction of cranking the winch. The wire cable has to be adjusted occasionally for the proper tension but this is done quite easily through tightening or loosening the eyebolts holding the cable to the wall just below the eaves of the roof. A wooden floor is laid level with the door sill. This floor is not a necessity, but it adds to the comfort of the observer and it is easier to clean.

The total cost of this observatory is not more than that of an ordinary garage and much less if undertaken by industrial-arts classes where materials alone are furnished.

SIMPLE FOUNDRY WORK

Gerald A. Boate, Seattle, Washington

Many occasions arise in the home or school workshop where a simple casting would overcome mechanical difficulty, or make possible the construction of a project that could otherwise not be undertaken. The lack of bearings, pulleys, cranks, and small machine and model parts need not keep the ingenious boy from making his own parts. It is even possible, by casting, to duplicate many small metal parts if a working knowledge of simple molding, combined with care and good common sense, is exercised. At times a small metal part may serve as its own pattern if it is not too complicated.

There are a number of metals that melt at low temperatures and pour easily which are suitable for small castings where strength is not important. A smith's forge, a basement heater, or a plumber's fire pot may be used as a melting furnace. Alloys composed of lead, tin, and antimony melt at low temperatures. Such alloys are: Magnolia metal, Babbitt metal, lumen metal, and the type metals junked at printing plants. Castings made from these metals are smooth and may be machined. Old plumber's lead pipe, pure tin, and scrap aluminum also may be used, although the latter is harder to melt and is subject to greater shrinkage.

Molding is work which is interesting. Care and good judgment and the ability to carry through a series of operations in the right order and at the right time are demanded. One slight slip-up may ruin all of the work which has been done in making the mold. Care and clear thinking are necessary all through the process.

The first requirement of successful molding is to have a suitable place where the work may be done, so that in addition to being tidy, all of the materials and tools necessary must be right at hand, so that the steps used in a foundry may be followed. A visit to a well organized up-to-date, small brass foundry will be both interesting and profitable, as here the flow of work and the complete molding process may be seen. In the brass foundry, one may see work done quickly under conditions similar to those found in the school or home workshop.

It is much easier to do good work on a bench rather than on the floor. To make molding clean and keep sand from being carried over the floor a molding bench such as is

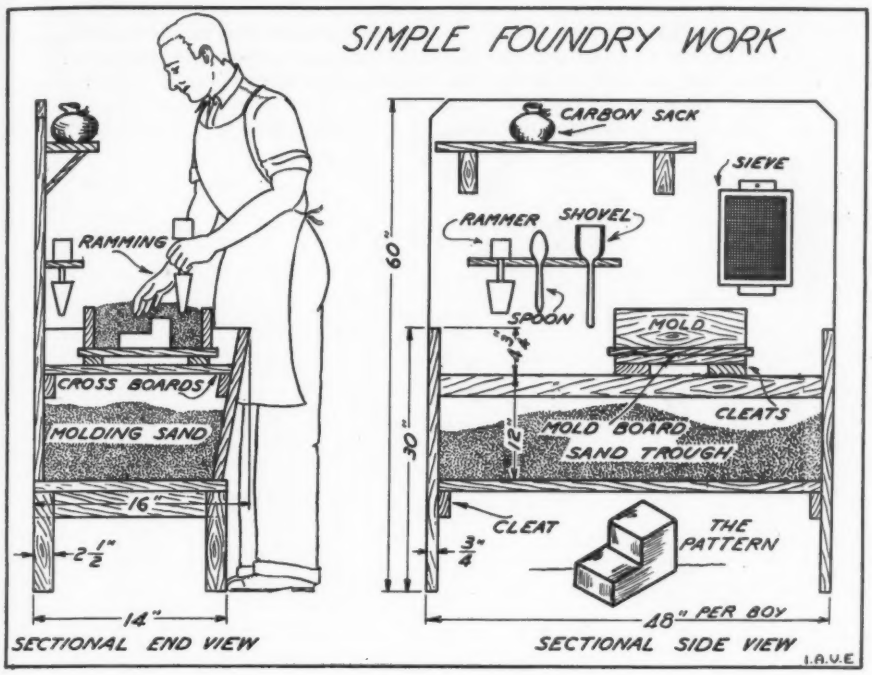


Fig. 1

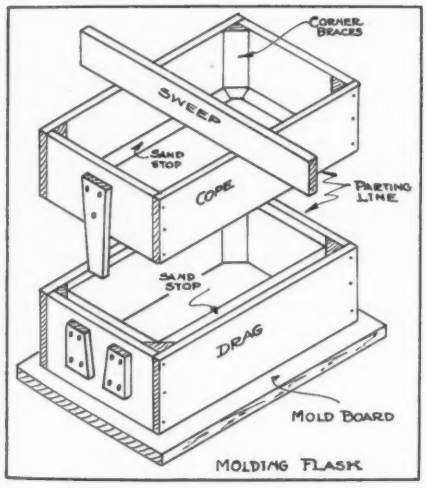


Fig. 2

shown in Figure 1 should be used. This molding bench keeps all of the molding sand and dirt right in one place. The trough will hold several cubic feet of molding sand which may be bought at any brass, iron, or steel foundry. Cleats and loose boards permit the flask to be supported slightly above the sand trough, so that sand may be sieved into the flask, and all surplus sand will fall back into the sand trough. The back not only provides shelf and hanging space for the tools needed, but it also keeps sand from falling over the back of the bench.

The tools needed for molding are few and easily made or bought. The molding bench is made of ¾-in. clear softwood boards, all joints being fastened with finish nails. The inside of the trough may be lined with galvanized sheet steel, or the wood and joints coated with roofing cement. Be sure that the bench is firmly nailed together and that it is level and rigid on its feet.

Most of the tools needed are shown on the bench back, where they are kept always within easy reach.

The carbon sack. On the upper shelf is a cloth bag made out of a piece of old cotton stocking. It is filled with "parting sand" which is dry, fine-grit sand, or powdered soft coal. It is used as a shaker for putting a layer of fine dust over the surface of the molding sand before the flask halves are put together. The parting sand keeps the sand in the two parts of the flask from sticking together.

Rammer. Hanging below is a hardwood stick turned with a cylinder of larger diameter on each end. One end is cut down wedge shape. This tool is called a rammer. Molders usually use one in each hand. Ramming is packing the sand carefully around the pattern and in the molding flask. It is a particular operation. If the sand is not rammed hard enough, it will fall out of the mold, as only the pressure against the sand stop keeps the sand from dropping out when the mold board is removed. The mold board is just a loose, smooth, flat board used only when ramming and handling the mold. If a mold is rammed too hard, the sand will crack and make the mold useless.

Sprinkler. The amount of water sprinkled into the molding sand while it is still in the sand trough should be only enough so that when sand is squeezed in the hand the imprint of the fingers will show in the sand.

Sieve. Before the sand is "wet-tempered," it should be shoveled over and carefully sieved to remove all lumps. A piece of wire screening such as is used in windows and doors is about the right size. Such a piece of screening may be inserted into the bottom of a small wooden box from which the bottom was removed. Use Cleats to attach the screening and nail a handle on each end so that shaking may be easy.

Shovel. A household ash shovel may be used for working over the molding sand and filling the sieve. It should not be used to fill the mold, as this should be done with the sieve by sifting.

Sweep. A wood straightedge longer than the molding flask is used for facing off the flask, or removing excess molding sand after the flask is rammed.

Spoon. This may be an old dessert spoon or teaspoon and is used for dressing up the mold and "coping out" the pouring channel "gate."

Mold board. Have not less than three smooth boards made 4 in. longer and 4 in. wider than the flask. Small wood cleats nailed crosswise will make lifting the flask off the floor easier after pouring.

Venting tool. A long piece of stiff wire used to form air holes in the mold over the pattern through which gas and steam, formed while pouring hot metal into the mold, may escape freely. If a mold is not vented, it is forced out of shape, and may blow up, ruining the casting being formed.

Sprue. Thin piece of brass pipe having a ¼-in. hole, which when worked downward through the sand will remove a core, leaving a hole which, when dressed and coped, becomes the pour hole. The "gate" between the pour hole and the mold is spooned out or "coped."

The molding flask. The wooden flask shown in Figure 2, consists of a carefully constructed wooden box of any convenient size which will fit on the cross boards placed in the molding bench. As the box has neither top or bottom, the corners should be strengthened by fastening in triangular-shaped blocks, marked corner braces. The dovetail cleats on each end, which take the place of dowels, are of the greatest importance, as later when the box is sawed in two to form the two parts of the flask, these parts must exactly fit every time the two parts of the flask are put together. Mark the box carefully for sawing. Also put a reference mark on the dovetail cleats on the part of the box marked "cope." These cleats may now be unscrewed and the box sawed in two, thus forming the two parts which are called the "cope" and the "drag." Where the cope and drag come together is called the "parting line." All around the parting line, both on the cope and on the drag,

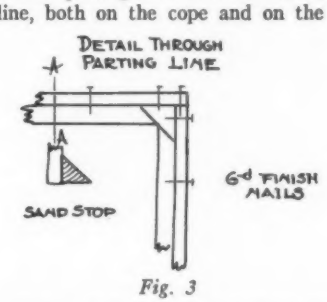


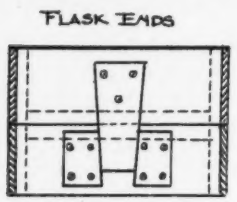
Fig. 3

there must be nailed triangular pieces of wood to form the "sand stop," as shown in Figure 3. This sand stop assists in keeping the sand from tumbling out of the cope and drag when

they are lifted. Surface the sawed edges so that a tight joint is formed when the cope is placed on top of the drag. Now replace the tail cleats as shown in Figure 4, putting them on exactly as marked.

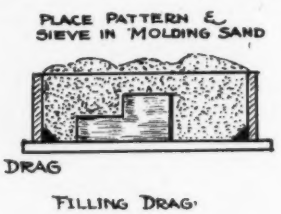
The mold board. This is a smooth loose board 4 in. longer and 4 in. wider than the flask. One surface may be cleated to make handling easier while moving the mold. It is advisable to have at least three mold boards which have flat, smooth, true surfaces.

Preparing for molding. Temper by sieving and sprinkling water on enough molding sand to fill a flask. Test for moisture by squeezing a ball of sand in the fingers. If it falls apart, add more water by sprinkling while turning the sand over and over with the shovel in very much the same manner as when hand-mixing concrete. If too much water has been added, sieve in more dry sand.



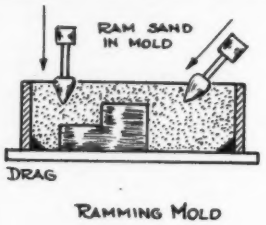
DOVETAILING CLEATS MUST BE SCREWED TO BOTH ENDS SO THAT COPE AND DRAG WILL ALWAYS LINE UP.

Fig. 4



FILLING DRAG

Fig. 5



RAMMING MOLD

Fig. 6

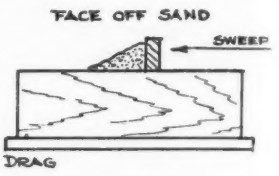


Fig. 7

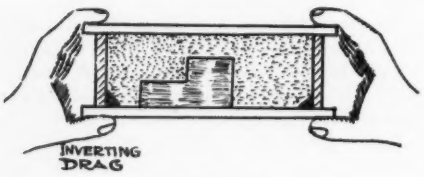
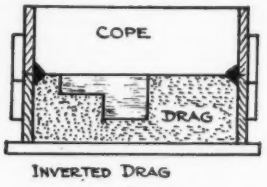
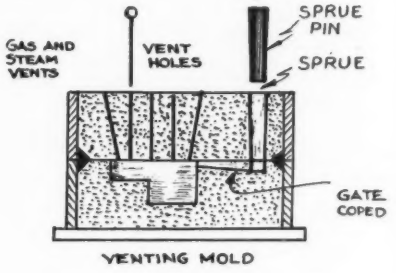


Fig. 8



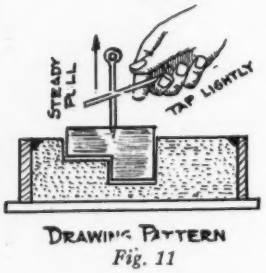
INVERTED DRAG

Fig. 9



VENTING MOLD

Fig. 10



DRAWING PATTERN

Fig. 11

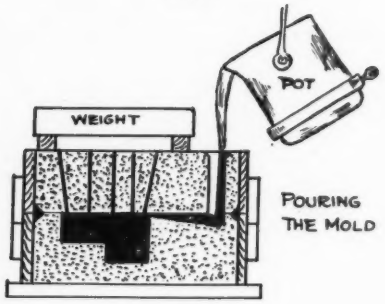


Fig. 12

Steps in Molding

1. Place the mold board on the cleats placed across the molding trough. Then carefully place the drag turned upside down, that is, with the sand stops in contact with the mold board. Place the pattern on the mold board over toward one end of the drag, being sure that the tapering of the pattern is upward. The taper is put on a pattern so that it may easily be withdrawn from the sand. Carefully sift molding sand all around the pattern, completely covering it as shown in Figure 5.

2. Using the ramming tool, pack the molding sand firmly but not hard all around the pattern, ramming harder near the sides of the flask than near the pattern. Use the tool as shown in Figure 6.

3. Remove all surplus molding sand by using the sweep, as shown in Figure 7.

4. Place a second mold board over the surface just faced and carefully turn the drag bottom upward as shown in Figure 8, then carefully place it on the cleats of the molding bench. Remove the mold upper board and carefully dust the whole surface with parting sand.

5. Carefully place the cope over the drag as shown in Figure 9, place the sprue pin in position, and repeat the steps 1, 2, and 3.

6. Using the venting tool, carefully punch a number of small holes right down to the pattern. Then remove the sprue pin and cut the pour hole down past the parting line. The holes are shown in Figure 10. Now place a mold board over the top of the cope and carefully separate the two halves of the flask so that the surfaces having parting sand will face upward. Place these on the cleats in the molding bench.

7. Draw the pattern as shown in Figure 11 by gently pulling and tapping the pulling iron with a short piece of steel rod or a spike. Utmost care and steadiness are required while drawing out the pattern. Dress up all broken edges with the coping spoon and blow out fallen sand. Cope out the pouring gate as shown in Figure 6.

8. By using two strips of board placed at each side of the vent holes and resting a flat weight on it, the tendency to blow the pattern will be reduced, and the weight also serves as a "safety-first" precaution, as there is a tendency to want to peep down these vent holes so that if hot metal were to shoot upward it is almost sure to hit the eye. See Figure 12. *Keep your face and hands away as far as possible from the mold while pouring.* Having heated more than enough metal, or alloy, pour it down the sprue toward one edge slowly and steadily so that the small pouring channel will not be choked. When the metal rises to the top of the sprue, stop. Skim off any dross or floating matter from the top of the melting pot before beginning to pour. Use wire hooks to hold and tilt the pot while pouring. Be careful and steady. Do not expect a good casting in the first attempt at molding. Inspecting the casting will tell where the trouble arose. Correct the error before trying again. Allow at least fifteen minutes before opening the mold. A pattern may be used over and over, but a mold must be made every time metal is poured in.

Clean, safe, simple molding is fascinating to the average boy, opening up for him a new outlet for his mechanical inclinations. The flask shown is a two-part flask, and the pattern is solid, therefore requiring no cores or core boxes. This lesson is called "simple molding" because all complications of the pattern and the mold are purposely avoided until the principles of parted patterns are understood.

Personal News

Mr. Shenk Elected to Teachers' College Staff, Millersville, Pennsylvania

Mr. John B. Shenk, of Lancaster, Pa., has been elected to the staff of the department of industrial arts, at the State Teachers' College, Millersville, Pa. Mr. Shenk received the degree of B.S. from the Millersville State Teachers' College in 1934, and has since that time been employed as an instructor in industrial arts and related subjects in the Boys' High School, Lancaster, Pa.

Association News

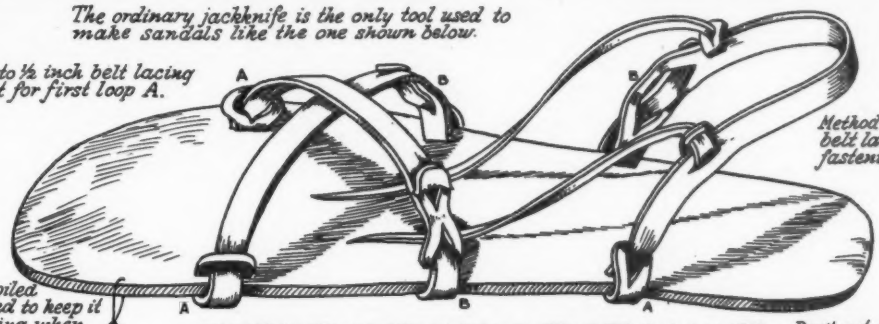
HOLD ANNUAL PRINTING CONFERENCE IN CHICAGO

The sixteenth annual conference on Printing Education will be held June 28 to July 1, in

(Continued on page 234)

The ordinary jackknife is the only tool used to make sandals like the one shown below.

3/8 to 1/2 inch belt lacing cut for first loop A.



Method of cutting belt lacing for fastening loop B.

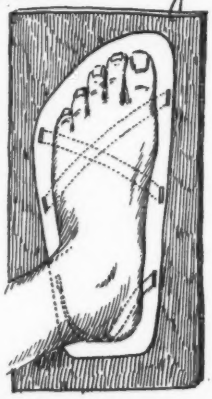
Rawhide should be oiled or varnished to keep it from softening when it gets wet.

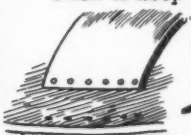
Don't cut your sandals too short. You can always cut off but not on.

SANDALS
OF RAWHIDE OR COWHIDE

SKETCHES & SUGGESTIONS BY W. BEN. HUNT, HALES CORNERS, WIS.

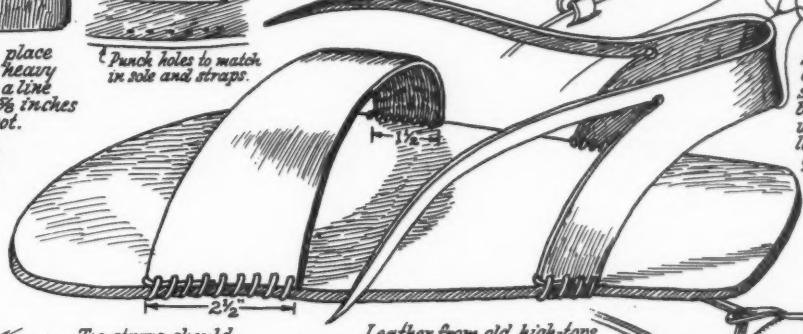
The first choice of leather for sandals is rawhide, if it is obtainable. The next is cowhide, but any heavy leather may be used. Leather or heavy canvas belting also makes good sandals. The Mexican peons use old auto tires for their sandals in this modern age. In some countries sandals are made of braided or woven straw. They may also be made of rope. Leather sandals should be oiled to keep them pliable. The leather for the straps should be rather flexible so as not to chafe the feet.





Punch holes to match in sole and straps.

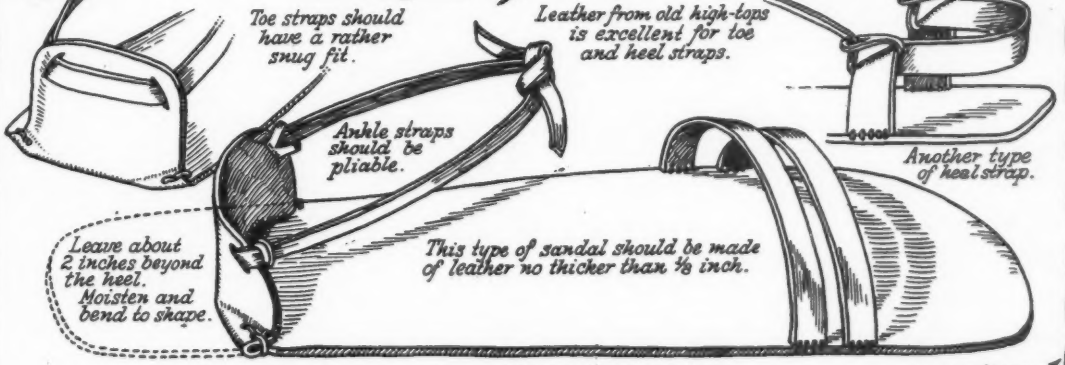
To make pattern, place foot on a piece of heavy paper and draw a line around, but ½ to ⅝ inches away from the foot. Holes for straps should be placed as shown above.



The above sketch shows the positions of the toe & heel straps. They should be laced to the sole with thin rawhide lacing or a good grade of belt lacing. Wet the heel strap and shape it as shown at left.

Toe straps should have a rather snug fit.

Leather from old high-tops is excellent for toe and heel straps.



Ankle straps should be pliable.

Another type of heel strap.

Leave about 2 inches beyond the heel. Moisten and bend to shape.

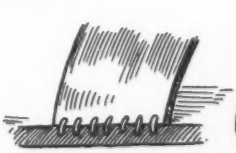
This type of sandal should be made of leather no thicker than ⅛ inch.

Below are shown some modern methods of fastening straps.

Fastening straps with tubular rivets.

Fastening with copper rivets.

Fastening with split rivets.



Method of sewing with waxed thread to prevent wearing out.

Enlarged view showing how thread is sewn.

Cross straps may be braided of soft leather and sewed to the sole

(Continued from page 232)

Chicago, Ill. Mr. David Gustafson, of North Park College, Chicago, will act as chairman.

At the opening session Mr. J. L. Frazier will speak on the subject, "What Worth While Has Come from the Typographic Revolution"; and Mr. Douglas C. McMurtrie, of Chicago, on "Printing, Ancient and Modern."

On the second day, the "New Developments in Graphic Arts Education," will be discussed, with Mr. Ralph W. Polk, of Detroit, in charge. Following this there will be group sessions on teaching problems, industrial arts in senior high schools, exploratory work in junior high schools, and teacher training in colleges and universities.

On the third day, the subject for discussion will be the "Graphic Arts Industries," with Mr. John A. Backus, of Elizabeth, N. J., in charge. At this session, the problems of paper, color, and ink, equipment, and processes will be taken up.

On the fourth day there will be a discussion on "A National Program of Graphic Arts Education," with Mr. Allan Robinson in charge. Among the speakers will be Mr. E. S. French, Washington, D. C.; Mr. E. S. Brown, East Chicago, Ind.; Mr. E. V. Harris, Atlanta, Ga.; Mr. F. Di Giacomo, Washington, D. C.; Mr. H. G. Crankshaw, Washington, D. C.; Mr. W. V. Harsha, Springfield, Ill.; and Mr. R. R. Karch, Pittsburgh, Pa. A symposium on student clubs will be in charge of Mr. H. H. Kirk, Washington, D. C. The closing address will be given by President Robinson, and the 1937 yearbook will be presented by Mr. C. H. Leuck of Lexington, Va.

DEPARTMENT OF VOCATIONAL EDUCATION WILL MEET IN DETROIT

Instructors of vocational and industrial-arts subjects who will attend the N.E.A. convention in Detroit, during the week of June 27, will find that they could not have spent their time more profitably. A fine and varied program has been arranged by Mr. Albert S. Siepert. Among the important speakers will be Mr. W. F. Patterson, secretary of the Federal Commission on Apprenticeship Training; Dr. Edwin A. Lee, director of Occupational Conference for New York City; and Dr. G. E. Myers, of the University of Michigan.

The meetings have been so scheduled that the visitors and delegates may make the most of their stay in this large industrial center. Transportation facilities have been reserved for trips through Detroit's leading factories, and for visits to the municipal zoological gardens, as well as to the Public Library, the Art Institute, the Ford plant, the Rotunda, and the Greenfield village. A variety of entertainment has been provided in the form of theater parties, boat excursions, and the like.

WESTERN ILLINOIS INDUSTRIAL-ARTS ROUND TABLE

The March meeting of the Western Illinois Industrial-Arts Round Table was held March 9, at Kewaunee, Ill. Forty men from Davenport, Rock Island, Moline, Galesburg, and other cities were in attendance. Paul McMorris was general chairman of the group, and Donald Hamm, Wethersfield, was director of the discussion group.

Mr. Howard Nelson, president of the society, had charge of the business meeting. He called attention to the Illinois Vocational Association convention, to be held in Peoria the latter part of March.

Messrs. Morgan of Monmouth, Johnson of Moline, and Bohm of Galesburg, were appointed to act as a nomination committee.

Mr. R. M. Robinson, of Kewaunee, entertained the group with a program of magic, after which a discussion was conducted on the topic "Methods of Grading." Mr. Landis, Kewanee, presented the topic "Selection and Design of Projects," in which he called attention to the fundamental principles in good design, and used illustrations to apply the principles to practical projects.

MU SIGMA PI ANNUAL DINNER DANCE

Mu Sigma Pi, the Graduate Industrial-Education Fraternity of Wayne University, in Detroit, Mich., held its annual formal dinner dance on March 19. Dr. Lessenger, dean of the University, was toastmaster, and Dr. Frank Cody, superintendent of the Detroit schools, was the guest of honor. Following the dinner, a short address was made by Mr. Earl Bedell. Entertainment between dance numbers was provided by students of the intermediate and high schools of the city.

ILLINOIS VOCATIONAL ASSOCIATION CONVENTION

The Illinois Vocational Association held its annual convention in the Pere Marquette Hotel, in Peoria, on March 26 and 27. Miss Litta Law, president, acted as chairman of the general sessions. For the first time in recent years the Association had a commercial exhibit and a large number of exhibitors took advantage of the facilities at the meeting. A feature of the meeting was the contest for students of mechanical drawing, auto mechanics, and molding. A large number of boys participated in these contests and the work was of a very high order. The general meetings were well attended and the sectional meetings attracted capacity audiences.

Among the subjects covered in the program were training of young men for the factory, developing leadership, opportunities for the undergraduate, trends in visual education, effective adjustment service, and a new basis for occupational classification.

There were a number of conferences on trade and industrial education, including agriculture, commercial education, home economics, industrial education, art education, industrial arts, trade and industrial education, guidance, automechanics and aviation, drafting, machine-shop work, printing, woodwork and general shop, and teacher training.

At the business session the following officers were elected:

President, Dr. L. V. Newkirk, Chicago; treasurer, Henry Hagen, Chicago. — *L. P. Elliott.*

INDIANA INDUSTRIAL EDUCATION ASSOCIATION CONVENTION

In school buildings that still showed the marks of the recent ravages of the Ohio River, the Indiana Industrial Education Association held its sixth annual convention at Evansville, April 9 and 10, 1937. From 9 a.m. Friday, April 9, when the convention was officially opened until 2 p.m., the members who came from all over Indiana had ample opportunity to visit school shops and the school and commercial exhibits that had been arranged in the gymnasium of the Central High School. From 2 until 4 p.m., sectional groups visited various industrial plants. The drafting section went to the International Steel Company, where guides took them through a large plant specializing in various types of structural iron work. Electrical instructors visited the Indiana Bell Telephone Company. Instructors of foundry and patternmaking had the opportunity of visiting the Vulcan Plough Works. At 6:30 p.m. all of these sectional groups met at the Servel Plant, manufacturers of the Electrolux refrigerators. In the recreation hall of the plant, a luncheon was furnished to the Association members and their friends without cost. After the luncheon, Mr. William Baker, plant manager, of Servel, Incorporated, gave an address in which he emphasized that industrialists are greatly interested in the shop teacher because they are training not only the workmen but the plant executives of the future. "Culture," he said, "is necessary, but the school emphasizes cultural subjects too much if the culture that is inculcated is not useful in making out of the boy a better member of society." He deplored the type of vocational education that was reserved only for "culls" of the school and urged that bright boys, too, should be chosen for industrial work, because they are sorely needed. R. J. Rogers, president of the foremen's club at Servel, compared the methods used in the shop for buying a piece of machinery and for hiring an employee. He explained that when a machine is to be bought, experts lengthily discuss the specifications. The bids are called for, the machine is erected, carefully and slowly run, and it is continually watched, and humored until it is put on a regular production schedule. In hiring an employee, however, no expert is consulted. A man is hired and he had better be good from the start or he is promptly fired. Mr. Rogers expressed the thought that the raw material in man power ought to be shaped and molded in school and by industry until the boy or the girl has developed at least something which will help him or her to make good in life.

The Epsilon Pi Tau Industrial Arts honorary fraternity held a breakfast meeting at 7 a.m., Saturday, April 10. At this meeting, A. H. Leuhring presided and Professor Orville E. Sink of Ball State Teachers College, Muncie, Ind., spoke on "Significant Trends in Industrial Arts." He divided industrial-arts teachers into three groups: Those who establish or help to establish trends, those who keep up trends, and those who are hopelessly behind. He emphasized the fact that industrial-arts instructors must work hard to get rid of their inferiority complexes, that there should be no antagonism between them and the general educational folks, and that all have to work together in developing integrated programs which thoroughly develop the entire student.

At the general session held in the auditorium of the Central High School from 8:30 to 10:30 Saturday morning, sectional meetings in drafting, electricity, foundry and patternmaking, and general shop, as well as in aeronautics, auto mechanics, machine shop, printing, and rural shop and woodwork were held. At the general-shop meeting, John R. Ludington, Professor of Industrial Arts, Ball State Teachers College, Muncie, Ind., spoke on "The General Shop of the Future." He showed that industrial arts is receiving more and more recognition; that a standard hard-fixed educational program cannot be relied upon to produce the best results; that the educational program must (1) orient the individual in the society in which he lives, (2) develop in him ways of thinking and solving problems, (3) develop him into a wholesome individuality; that the major problems of life cannot be departmentalized; that we have emphasized making instead of thinking, planning, and problem solving. He showed that the industrial laboratory with its varied industrial materials, and with its relationships between industrial arts, art, and science, most nearly solves our problems. Sylvan A. Yager, Indiana State Teachers College, described the general shops which he had visited during 1936. He pointed out that of the 225 teachers visited, 50 of whom were not located in the State of Indiana, he had found very little emphasis on related material, few reference books, and a majority of teachers who had no outline of the course which they were teaching. He found, however, that most teachers were professionally active, that they attended district and state meetings. He found only one teacher who

(Continued on page 5A)

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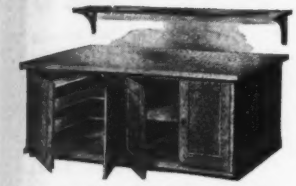

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(Continued from page 234)

did an excellent teaching job but who did not attend such meetings.

At the business session, the following officers were elected for the next year: Warren A. Pease, Industrial Arts Supervisor, Evansville, president; Walter Bunker, East Chicago, vice-president; H. G. McComb, West Lafayette, secretary-treasurer. News of the associations

INDUSTRIAL-ARTS CONFERENCE

The Annual Industrial-Arts Conference, held on April 10, at the Millersville (Pa.) State Teachers' College, attracted more than four hundred school administrators and industrial-arts teachers. Two hundred and fifty of those in attendance remained for the luncheon program.

The conference opened with an inspection of a fine array of current industrial-arts equipment and supplies displayed by some twenty commercial exhibitors. A number of valuable teaching aids were also on display. A feature of the exhibit was a two-hour showing of motion-picture films useful as visual aids to industrial-arts teachers.

The theme of the conference was "Industrial-Arts Contributions to Society." A feature of the conference was an interesting talk on "The Extension of Industrial-Arts Values," by Gilbert Weaver, teacher-trainer of New York State. Mr. E. E. Howard, of Millersville, toastmaster, introduced Mr. Fred Smith, who made some timely remarks on current legislation. A number of five-minute talks were given on various aspects of industrial-arts values. Lindley Dennis gave the summary, and Mr. W. C. Geyer showed moving pictures which he made of the 1936 olympics in Germany. The conference closed with the initiation and banquet of the Iota chapter of the Iota Lambda Sigma Fraternity. — *E. E. Howard.*

SPRING MEETINGS OF THE KENTUCKY TEACHERS

The industrial-arts teachers of Kentucky held two spring meetings during 1937. Louisville was host to the annual convention of the Kentucky State Industrial-Arts Association on April 15 and 16, while the Northern Kentucky Industrial-Arts Association held a conference at Fort Thomas on May 1. Mr. Louis H. Rogge welcomed the teachers of the state to the Louisville meeting, and Mr. John A. Whitesel presided at the first session. Mr. N. G. Deniston, of Eastern State Teachers' College, Richmond, discussed "Trends in Industrial Arts as Observed in the West." A round-table discussion on "Industrial Arts in Kentucky Schools" was conducted by Mr. H. L. Oakley, of Georgetown, Mr. E. O. Eiken, of Louisville, Mr. Marshall Hurst, of Newport, and Mr. E. W. Lockin, of Berea.

Mr. C. L. Jordan, principal of the DuPont Manual Training High School, Louisville, presided at the second session. Dean Clyde A. Bowman, of Stout Institute, the guest speaker, talked on "The Significance of the George Deen Act and Other Legislation." Mr. L. T. Smith, of Western Teachers' College, Bowling Green, addressed the group on "The Place of Industrial Arts in a Program of General Education."

The third session, which was a luncheon program, was in charge of Mr. Leonard Daugherty, supervisor of industrial arts, Louisville. Dean Clyde A. Bowman, Stout Institute, talked on "State-Wide Standards for Industrial Arts," and George Kannapel, of the Louisville Wood Mosaic Company, discussed "The Romance Revealed by Veneers."

Mr. Louis H. Rogge had charge of the business session. A state constitution was presented by John A. Whitesel and plans made for its adoption in 1938.

The officers elected for 1938 were as follows: President, John A Whitesel, Dayton; vice-president, Leonard Daugherty, Louisville; secretary-treasurer, Norman J. Ranum, Somerset. Members of the executive committee: George H. Richards, Louisville; Walter B. Nalbach, Bowling Green; and the officers.

The conference at Fort Thomas, on May 1, sponsored by the Northern Kentucky Industrial-Arts Association, was attended by those interested in industrial arts from the states of Kentucky, Ohio, and Indiana. Mr. John A. Whitesel, president of the association, presided at the meeting. Dr. William E. Warner, of Ohio State University, the guest speaker, addressed the group on the subject, "Industrial Arts: Its Antecedents and Program." Following the talk a panel discussion was held under the direction of Mr. Elmer W. Christy, of Cincinnati, Ohio. The topic was "What I See for the Industrial-Arts Program in My School." — *J. A. Whitesel.*

CONFERENCE OF TRADE DIRECTORS

A four-day conference of directors and coordinators of trades and industries was held April 19 to 22, in Fort Wayne, Ind., under the leadership of Allen T. Hamilton, state supervisor of industrial education. Supt. Merle J. Abbett, of Fort Wayne, welcomed the group. Mr. N. B. Giles, conference leader, drew out of the group a well-organized method of attacking vocational problems. Among those in attendance were F. E. Benson, R. W. Igne, A. E. Jackson, W. J. Middleton, E. T. Orggan, W. A. Pease, G. H. Russell, Guy Stantz, H. E. Taylor, G. F. Weber, Paul Bergevin, Herbert Kessell, Kal Ferguson, James Jenkins, H. E. Matson, H. W. Schulze, E. J. Spady, E. Warrick, A. L. Angel, M. L. Laubach, R. J. Greenly, H. G. McComb, Ammon Swope, and Allen T. Hamilton. — *H. G. McComb.*

(Continued on page 6A)

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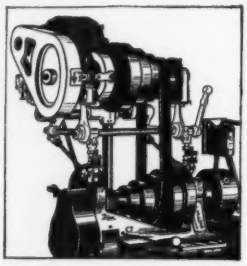

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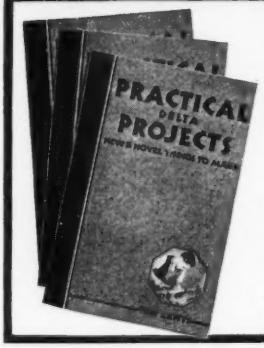

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(Continued from page 5A)

MICHIGAN INDUSTRIAL EDUCATION SOCIETY

On April 22, 23, and 24, 1937, Grand Rapids was host to the Michigan Industrial Education Society which held its tenth annual convention in that city. As usual, the Michigan shop teachers attended *en masse*.

The convention was officially opened on Thursday at 3:30 p.m. when the registration began. At the administration dinner held Thursday at 6:30 p.m., President Luther E. Hail presided. The main address on this occasion was given by Dr. Paul V. Sangren, President of Western State Teachers College, who spoke on "Advanced Training for Teachers in Industrial Arts." The city directors council breakfast took place Friday at 7 a.m. It was presided over by E. C. Russell, Director Vocational Education, Pontiac. At this meeting, Harold Van Westrienen, Director Vocational Education, Hamtramck, was elected as chairman for next year, and Andrew Althouse, Supervising Instructor of Industrial Arts, Detroit, as secretary.

Director George E. Myers reported on the study which his committee has made on terminology in the field of industrial arts and industrial education. These terms have been divided into five groups, one on general education, another on vocational education, a third on industrial arts, a fourth on industrial economics and a fifth on agriculture and home economics.

In the conference which considered the preparation for employment, Professor Thomas Diamond was chairman. A large number of questions had been submitted for discussion. Out of these it was decided to discuss only one, "What Effect Would It Have to Promote Two-Hour Daily Shop Periods in Our Comprehensive High Schools with the Idea that Such Shop Programs Would Have Strictly Trade or Trade Preparatory Standards?"

Mr. Harry Burnham, speaking on this subject, stated that at Flint, 30 promising boys are picked each year, and these are given a two-hour shop period. In order to do this, however, these students have to start at 7 a.m. Mr. George H. Fern, answering a statement that the work proposed by this question would not meet Smith-Hughes standards which require three hours shopwork per day, and which, therefore, would not be eligible for Smith-Hughes funds, said that in considering an educational question, the student and the effect on him have to be taken into account, and not whether the work is reimbursable by Smith-Hughes funds. He called attention to the fact that the tendency is not to employ boys until they are 18 years of age, and suggested that a two-year preapprentice course be offered to boys at the age of 16, and industrial-arts courses for those below 16. He pointed out that boys receiving a double period in sheet-metal work produce three times as much work as they did in the one period previously given. Mr. Arthur L. Reagh stated that at Grand Rapids, the double-period shop is common in all high-school shops, and that it does not interfere with the program in any way.

At 9 a.m., Friday, the Future Craftsman program was held, at which Mr. Carl Turnquist presided. At this meeting, there was a demonstration of how the Michigan Future Craftsmen of America ritual is to be presented. This was done by students of Detroit high schools. There was a proofreading contest, a public-speaking contest, and a board-sawing contest.

Friday afternoon, there were a number of divisional meetings, one on vocational and trade education, another on industrial arts for the junior and senior high school, a third on part-time continuation schools, another on industrial arts for consolidated and village schools, and another on women's trade and industrial education.

At the banquet on Friday evening, Mr. Earl L. Bedell, State Director of Vocational Education, Detroit, served as chairman in the place of President Luther E. Hail. The toastmaster on this occasion was Mr. Harry Taliaferro, President of the American Seating Company. The address of welcome was given by Mr. Harry Hart, who spoke in place of the mayor of the city of Grand Rapids. On this occasion, the members of the Michigan Industrial Education Association presented Mr. K. G. Smith, State Supervisor of Industrial Education, and wife, with an extended vacation trip, in appreciation of his accomplishments and of his continued interest in their work.

The main address was given by Dr. Homer J. Smith, Professor Industrial Education, University of Minnesota, Minneapolis, Minn., who chose the subject "What Shall We Say to the Youth of Today?" In this address, he emphasized that every teacher is a guidance worker and needs a philosophy to guide him. The speaker pointed out that one of the things which those in charge of guidance must not overlook, is that the average youth has ambitions that are unrealizable, that guidance at times must set itself the task of offering mass discouragement. The census reports show nine or ten occupational classifications. The percentages of workers who are employed in these classifications are practically fixed. According to these percentages, about 7 per cent of the workers will be needed to fill professional opportunities. Yet, if the high-school boys and girls are asked

(Continued on page 9A)

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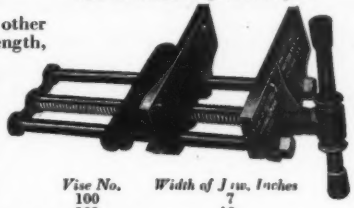

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Engineered POWER TOOLS

(Continued on page 6A)

to state their preferences, 30–85 per cent indicate a professional choice. This indicates that these youngsters must be led to change their choices to something that they can eventually do.

It is therefore, better to find out from the high-school students what subjects they do not like. They will probably be failures in these areas. Give the youth generalities which have been true for a long time. For instance, show them the definite relation between length of training period and eventual monetary return. Show them that while people do not usually produce changes in an occupation, nevertheless occupations definitely change people. If a boy wants to be a doctor, tell him to study a gathering of such men to learn what he will be like in twenty or more years. Tell the students to stay out of trades in which both sexes compete too closely. Above all, do not foist the old saying on them that every boy can become president. There is no truth in it. Do not emphasize too strongly that promptness, industry, honesty, lead to wealth and success. All of these characteristics are needed in every trade to make a livelihood. Tell them that versatility is better than specialization because 85 per cent of the workers must be versatile, since one specialist can take care of a veritable army of those who have general training. Do not try to push your finest and brightest boy graduate into a bank unless he has money to buy some bank stock or can marry a banker's daughter. Train them rather that they should prepare for a shorter work span. The time is past when the boy at 16 starts to work and then is supposed to have saved enough money at 60 so he can live to 65. At present, the outlook is that he will not have a job until he is 18 or 20 but that he will have to earn and save enough money so that at 50 he can live without work until he is 75.

Saturday morning an Epsilon Pi Tau breakfast was held with Mr. Dewey F. Barish, Flint, in charge. After the breakfast, those who attended were invited to visit the Mu Sigma Pi room to look at some exquisite examples of accuracy as exemplified by some of the special sets of Johannson gauges loaned to the Mu Sigma Pi Fraternity for this convention. At this time, also round-table conferences on safety, aeronautics, and auto mechanics, electricity, general shop and woodwork, heating and ventilating, part-time and continuation school, printing, patternmaking and foundry, machine shop and forging, and rural-agricultural education were held. At the noon luncheon Saturday, Elmer C. Weaver, State Teachers College, Kalamazoo, presided. The toastmaster on this occasion, was George F. Fern, State Director Vocational Education. Addresses were given by N. B. Giles Central Regional Agent for Trade and Industrial Education, Washington, D. C., and J. Stannard Baker, National Safety Conference.

At the business session, the following officers for next year were elected: Elmer C. Weaver, State Teachers College, Kalamazoo, president; Arthur L. Reagh, Supervisor of Industrial Arts, Grand Rapids, vice-president; Thomas Garrity, Detroit, secretary-treasurer.

The place for the next meeting will be announced later.

Safety Exhibit at Cass Technical High School

The Aero Club of the Cass Technical High School, in Detroit, Mich., sponsored an educational campaign for the promotion of safety, in which the emphasis was placed on the need for safety on land, in the air, and in the water. Traffic charts were prepared and used in motion pictures telling the complete story of safety hazards.

School-Shop Equipment News

PORTER-CABLE PORTABLE BELT SANDER

The new heavy-duty, portable, take-about belt sander, just placed on the market by the Porter-Cable Machine Company, Syracuse, N. Y., fills the need for a balanced and dustless 4-in. portable belt sander.

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(Continued on page 11A)

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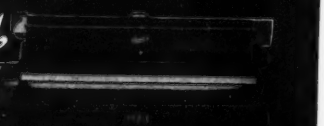
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(Continued from page 9A)

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The Type T-4V sander is useful for resurfacing of school desks, tables, and cabinets, and for grinding metal strips, plates, grills, and other metal parts. Complete information will be sent to any shop instructor upon request.

HIGGINS ANNOUNCES NEW TYPE INK BOTTLE

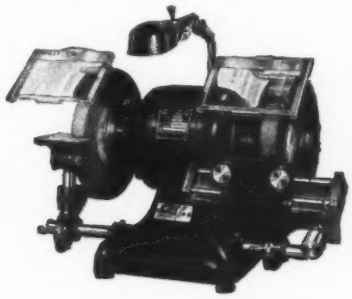
The C. M. Higgins Company, 271 Ninth St., Brooklyn, N. Y., has announced a new type of drawing ink bottle, featuring new distinctive labels and attractive individual cartons of modern design. Both the cartons and labels use black as a background and incorporate the distinctive Higgins design of a circle on a square, now used on the labels for all items of desk size. The cartons are sealed on both ends, to insure delivery to the consumer in the original, unopened package, and to facilitate the handling of individual cartons in the warehouse and retail store. The individual cartons of each color are packed by the dozen in attractive display containers showing the Higgins color wheel.

The Higgins drawing inks, in addition to the waterproof and soluble blacks, now includes 13 spectrum hues, 4 supplementary shades, also white and neutral tint.

Complete information regarding any of the Higgins inks, may be obtained upon request.

NEW STANLEY EDGE-TOOL GRINDER

The new No. 667 edge-tool grinder, just placed on the market by the Stanley Electric Tool Division, New Britain, Conn., is an improved bench grinder suitable for school and industrial woodworking shops.



The new edge-tool grinder has a ⅓ h.p. induction motor, two specially built 7-in. wheels for edge-tool and general-purpose grinding, a ball-bearing motor, and grinding wheels fully protected except at the working area. The special features include a patented attachment for holding and grinding plane irons up to 2⅝ in. width, and chisels of any size, a light fixture which may be adjusted to any position, a toolrest, and a pair of safety eyeshields.

ISSUE HANDBOOK OF MACHINE FASTENERS

The Russell, Burdsall & Ward Bolt & Nut Company, Port Chester, N. Y., has just issued a small Handbook of Common Machine Fasteners.

The booklet contains twenty pages, and is made to fit into the average drawing-instrument case. It has been developed as a part of the draftsman's equipment, and contains 26 illustrations of the latest accepted standard method of drawing various styles of bolts, nuts, and rivets.

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INDEX TO ADVERTISEMENTS

Abernathy Vise 8A
Adjustable Clamp Co..... 10A
American Gas Furnace Co..... 10A
American Saw Mill Machinery Co. 8A
American Technical Society... 10A
American Type Founders Sales Corp. 9A
Armstrong Bros. Tool Co..... 2A
Atkins and Company, E. C.... 6A
Atlas Press Company, The.... 2A
Badger Electrotype Company.. 12A
Baltimore Teachers Agency, The 12A
Bemis, A. L..... 10A
Boehm Bindery, The 12A
Bruce Publishing Company, The .....Fourth Cover & 7A
Chicago Wheel and Mfg. Co... 8A
Columbian Vise & Mfg. Co..... 12A
Delta Mfg. Company..... 6A
Dixon, Inc., William..... 8A
Driscoll & Company, Martin.. 10A
Dumore Company, The..... 10A
Fanwood Specialties Company. 8A
Foley Lumber Company, T. A. 10A
Gardiner Metal Company..... 9A
Hall & Sons, W. A..... ..... 11A
Hammett Company, J. L..... 12A
Hartford Clamp Company.... 12A
Huther Bros. Saw Mfg. Co.... 1A
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LeBlond Machine Tool Co., The, R. K.....Fourth Cover
Lombard and Company 8A
Lussky, White and Coolidge... 8A
Manley Products 6A
Metal Crafts Supply Co..... 12A
Morgan Vise Company..... 9A
Mummert-Dixon Company 12A
Murphy's Sons Co., Robert... 8A
National Lead Company..... 12A
Nicholson File Company..... 6A
O'Brien Lumber Company.... 12A
Oliver Machinery Company... 1A
Osborn Bros..... 10A
Ozalid Corporation 10A
Paxton Lumber Co., Frank.... 12A
Porter-Cable Machine Co..... 4A
Russell Electric Company..... 12A
Smith, Clifford B..... 10A
Snap-On-Tools, Inc. 4A
South Bend Lathe Works, ...Second Cover
Sta-Warm Electric Company.. 10A
Stanley Rule & Level Plant... 1A
Swan Pencil Co., Inc..... 10A
Thurston Supply Company.... 11A
Toles Company, W. C..... 10A
U. S. Blue Company... ..... 10A
Walker-Turner Co., Inc..... 9A
Wallace Company, J. D..... 4A
Weber Company, F..... 12A
Western States Envelope Co... 2A
Western Stoneware Company. 12A
White Metal Rolling and Stamping Company..... 8A
Whiting Co., E. B. & A. C.... 10A
Williams and Company, J. H.. 2A
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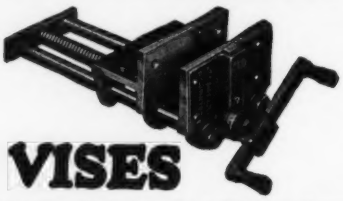

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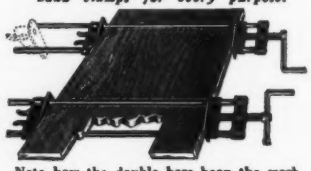

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INDUSTRIAL ARTS and VOCATIONAL EDUCATION

August, 1937
Vol. 26, No. 8

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CONTENTS

Research Possibilities in the Laboratory Organization — III, *by L. F. Ashley* 235
Maladjustment and Learning in Relation to Interest, *by Gilbert L. Betts* 237
Electric-Motor Maintenance, *by Carl J. Schliep* 238
Sources of Occupational Information, *by L. N. Recktenwald* 239
The Study of Printing Paper, *by R. Randolph Karch* 240
Small or Large Drafting Classes — Which?, *by O. A. Northquest* 244
How We Run Our Stamp Club, *by R. R. Bedker* 246
Editorial 251

Tests and Testing

A General-Shop Test, *by Hugh Norris* 252

Problems and Projects

Unit Projects in Mechanical Drawing, *by W. A. DeVette* 254
Bench Tool Holder, *by John Worthington* 254
Rack for Small Brushes, *by D. C. Marshall* 255
Pencil Pointer, *by Clyde Thorp* 255
Mallets from Old Belts, *by Walter C. Van Buren* 255
Water Still for Battery and Science Problems, *by Herbert C. Phelan* 256
Self-Assigning Clean-Up Chart, *by Deane E. Eldridge* 257
Knife Sheaths and Ax Sheaths, *by W. Ben. Hunt* 258
Photo Printer for the School Shop, *by Leland A. Benz and Lawrence F. Simmering* 259
A Reminder for the Shop Teacher, *by J. Edward Bond* 260
Combination Chase and Galley Rack, *by Fred W. Bergmann* 261
Tools Stored Where Used Best, *by J. Edward Bond* 261
Interesting Facts Regarding Solder, *by James C. Shaw* 261

Supplements

Unit Projects in Mechanical Drawing, *by W. A. DeVette* .....No. 343
Setting a Hinge, *by Clifford B. Smith* .....No. 344

New Publications 262
Personal News 262
Association News 5A
News Notes 8A
School-Shop Equipment News... 9A

THE AUGUST ISSUE

The current issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION has been prepared with special consideration for readers with diversified interests. To shop teachers who believe in keeping in the forefront of their profession, and to those who attend summer school, the following articles will be of special interest: "Research Possibilities in the Laboratory Organization — III," by L. F. Ashley; "Maladjustment and Learning in Relation to Interest," by Gilbert L. Betts; "Sources of Occupational Information," by L. N. Recktenwald; "Small or Large Drafting Classes — Which?" by O. A. Northquest; "General-Shop Test," by Hugh Norris.

For the school-shop printer, the "Study of Printing Paper" by R. Randolph Karch will be timely and informative. To the teacher of electricity, whether he be in the junior or senior high school or in the full-time or part-time vocational school, the article on "Electric-Motor Maintenance," by Carl J. Schliep will be helpful.

To the drafting teacher, "Unit Projects in Mechanical Drawing," by W. A. DeVette in supplement form may be quite welcome. For the teacher who wants to improve his shop organization, the "Self-Assigning Clean-Up Chart," by Deane E. Eldridge and "A Reminder for the Shop Teacher," by J. Edward Bond may suggest helpful ideas. For the teacher interested in club work, R. R. Bedker's "How We Run Our Stamp Club," will be very helpful, and for those working with boy scouts or in boy camps, W. Ben. Hunt's "Knife Sheaths and Ax Sheaths," will be of special interest.

The shop utilities show what some teachers have done in trying to make their shopwork function more efficiently. Many readers may have developed similar devices and kinks. They, too, would be helping their fellow teachers if they would submit their ideas for publication.

Articles Indexed — The articles contained in the Magazine are regularly indexed in "The Reader's Guide to Periodical Literature," and "Education Index."
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Teach them..

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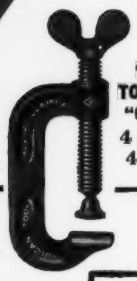

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Diameter of wheels	16"
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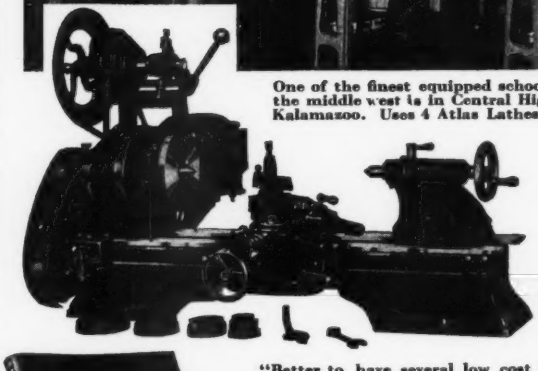

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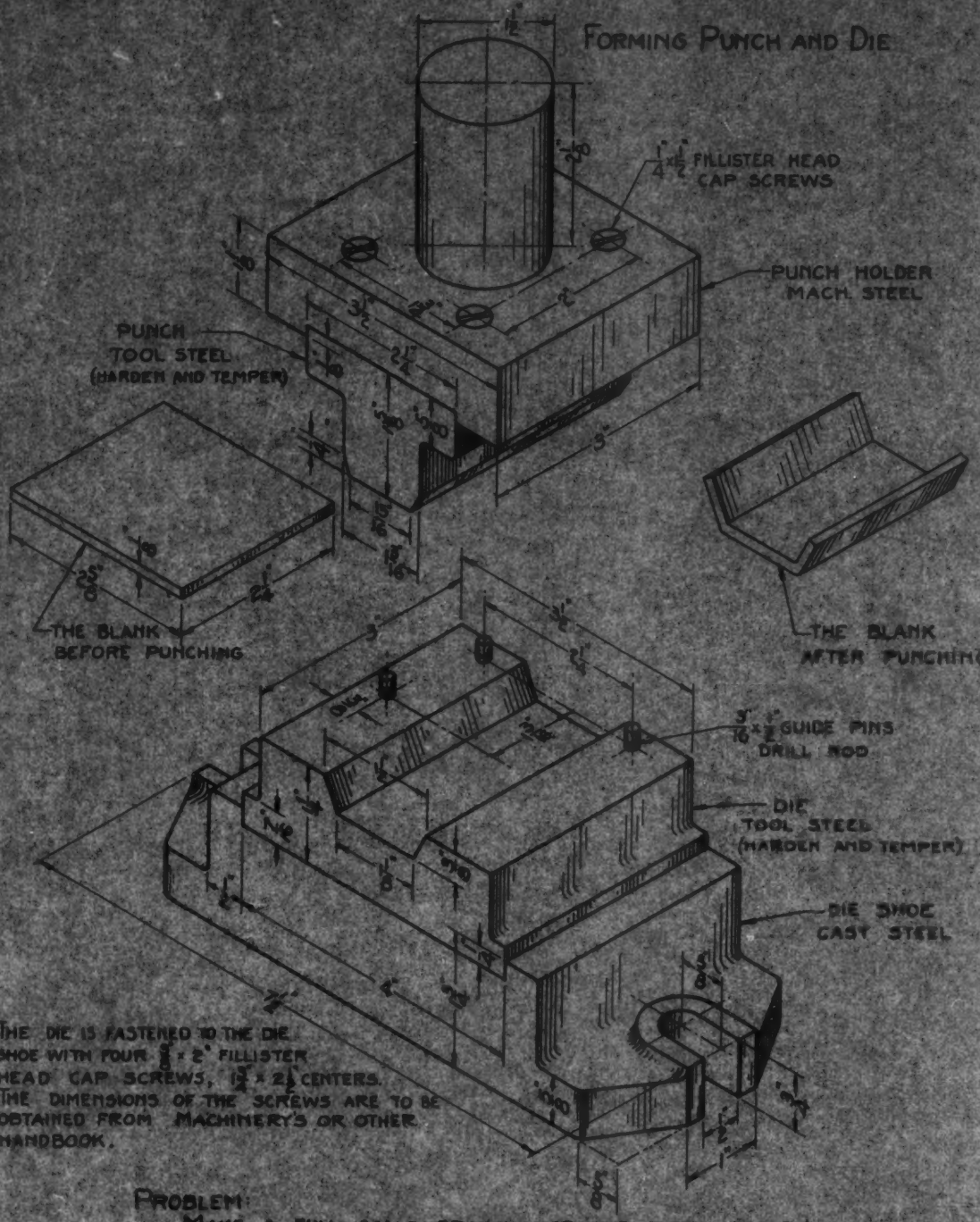
FORMING PUNCH AND DIE


1½
1¼ × ½ FILLISTER HEAD CAP SCREWS
PUNCH HOLDER MACH. STEEL
PUNCH TOOL STEEL (HARDEN AND TEMPER)
THE BLANK BEFORE PUNCHING
THE BLANK AFTER PUNCHING
⅜ × ½ GUIDE PINS DRILL ROD
DIE TOOL STEEL (HARDEN AND TEMPER)
DIE SHOE CAST STEEL

THE DIE IS FASTENED TO THE DIE SHOE WITH FOUR ⅝ × 2" FILLISTER HEAD CAP SCREWS, 1¾ × 2½ CENTERS. THE DIMENSIONS OF THE SCREWS ARE TO BE OBTAINED FROM MACHINERY'S OR OTHER HANDBOOK.

PROBLEM:

MAKE A FULL-SCALE DRAWING OF THE PUNCH AND DIE CONSISTING OF A TOP VIEW OF THE MOVING PART (THE PUNCH AND PUNCH HOLDER), BELOW THIS A TOP VIEW OF THE STATIONARY PART (THE DIE AND DIE SHOE) AND UNDER THIS A FRONT VIEW OF BOTH IN CLOSED POSITION SHOWING THE WORK, ALREADY FORMED, IN RED. SHOW ALL DIMENSIONS FOR MAKING EACH PART AND ALSO THE SHUT HEIGHT FROM THE BOTTOM OF THE DIE SHOE TO THE TOP OF THE PUNCH HOLDER BUT NOT INCLUDING THE ROUND SHANK AT THE TOP.

Submitted by W. A. DeVetis, Wilson Junior High School, Erie, Pennsylvania (See page 254 for further details)

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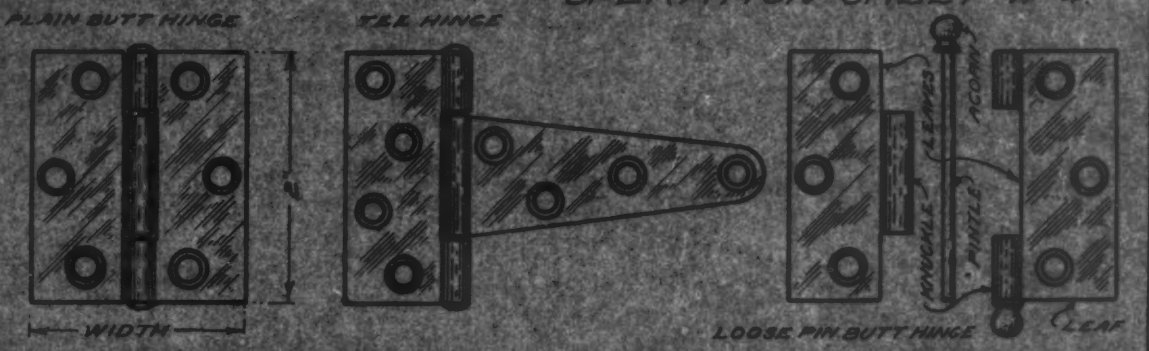
SETTING A HINGE

Elementary Woodwork.

OPERATION SHEET W-4.



'HE WHO PROCRASTINATES STRUGGLES WITH RUIN' Hasted

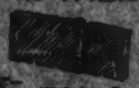
KINDS – HINGES ARE FURNISHED IN DIFFERENT MATERIALS, SUCH AS STEEL, BRASS, BRONZE, ETC. – THEY ARE NAMED ACCORDING TO SHAPE OR USE. AT -A- WE HAVE THE MOST COMMON HINGE, KNOWN AS A BUTT HINGE. IT COMES IN FOUR STANDARD WIDTHS, NAMELY,- NARROW, MEDIUM, BROAD AND DESK. YOU ORDER IN THIS MANNER,- 1 PAIR 1½" MEDIUM BRASS BUTTS. LOOSE PIN. –

-A- BUTT

OTHER KINDS ARE THE TEE, THE CHEST, THE STRAP AND THE TABLE. –

-B- TEE

-C- CHEST


-E- TABLE

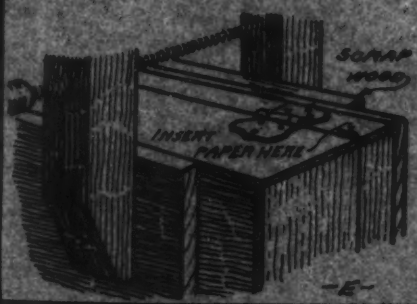
-D- STRAP

DIRECTIONS – 1- ORNAMENTAL HINGES. –

A- STUDY SKETCH -E-. –

B- PLACE SMALL PIECE OF PAPER BETWEEN COVER AND THE LOWER PART OF THE BOX. DO THIS AT BOTH ENDS. CLAMP TOGETHER WITH A HAND SCREW, PROTECTING THE BOX WITH SCRAP WOOD ON BOTH SIDES. CHECK EDGES ON ALL SIDES TO BE SURE THE SURFACES ARE PERFECTLY IN LINE AND FLUSH. –

C- LOCATE POSITION OF THE TWO HINGES. SIMPLY DECIDE ON HOW FAR IN YOU DESIRE THE HINGES. MEASURE THIS DISTANCE ON BOTH SIDES USING A KNIFE TO MARK THE DOT WITH. THIS DOT MUST NOT SHOW. –



-E-

D- LINE UP THE KNUCKLE OF THE HINGE WITH LINE OF COVER AND THE BOTTOM SECTION OF THE BOX. SEE SKETCHES -F- AND -G-. MARK HOLES (THEIR CENTER) WITH SCRATCH AWL. –

LINE KNUCKLE UP WITH EDGE OF COVER -F-

E- DRILL ONLY ONE HOLE FOR EACH LEAF, USING A NAIL DRILL. INSERT SCREWS AND TEST IF CORRECT PLACE REMAINING SCREWS. –

THIS HINGE IS OUT OF LINE. -G-

2- BUTT HINGES. THEY ARE NEVER APPLIED IN THE MANNER OF THE ORNAMENTAL HINGE. IT REQUIRES GREAT CARE FOR A GOOD JOB. –

A- CLAMP PARTS TOGETHER AS SHOWN AT -K-. KEEP ENDS FLUSH. WITH SHARP PENCIL SQUARE LINES a-a FOR EXACT LENGTH OF HINGE. –

-N-

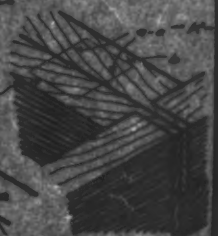
B- REMOVE CLAMP AND SQUARE PENCIL LINES d-d. –

C- STUDY SKETCHES -H- AND -J-. SET MARKING GAUGE TO CENTER OF KNUCKLE AS AT -H-, OR JUST TO IT AS AT -J-. NOW GAUGE LINES b-b EXACTLY BETWEEN a-a. –

-J-

D- SET MARKING GAUGE AT A LITTLE LESS THAN HALF THE THICKNESS OF KNUCKLE AND GAUGE LINES c-c. –

E- WITH MALLET AND CHISEL CUT INSIDE LINES. SEE -L- PARE TO LINES. SEE -M-. –


-K-

-L- -M-

Submitted by Clifford B. Smith, Buffalo, New York

UNIV. OF MICH.